

REPORT
ON
MOVING PERSONNEL & LIGHT MATERIAL
ONTO A SHIP
&
ABOUT A SHIPYARD

Prepared for:
AVONDALE SHIPYARDS, INC.

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TABLE OF CONTENTS

FOREWORD

ACKNOWLEDGEMENTS

1. EXECUTIVE SUMMARY

1.1	The Purpose of This Project	1
1.2	Objectives	1
	Scope	1
1.4	Meaning of "Light Loads"	1
1.5	Exclusion: Plant Engineering and Maintenance Use of Vehicles	3
1.6	Summary of Conclusions & Recommendations	3

EXHIBIT:

I-1 AVONDALE MAIN YARD

2. PRESENT MATERIAL HANDLING SYSTEM WITHIN THE SHIPYARD

2.1	Overall Light Equipment Control	7
2.2	Transport Equipment and Containers	11
2.3	Light Load Weights	12
2.4	Material Classifications	13
2.5	Light Load Movements	13
	Light Load Warehousing Area Dispatching	13
2.7	Truck Dispatch System	15

EXHIBITS:

II-1	AREA LAYOUT SHOWING FORK TRUCK ASSIGNMENT ZONES
II-2	EQUIPMENT LIST - LIGHT LOADS
II-3	AVONDALE "MULE-TRAIN"
II-4	TOWER CRANE
II-5	STAKE BODY TRUCK WITH PIPE BASKETS
II-6	FLAT BED TRAILER PULLED BY YARD JOCKEY
II-7	MULTI-PALLET SELF LOADING LIFT TRUCK
II-8	TYPICAL 6000 LB. CAPACITY FORK LIFT TRUCK
II-9	"YELLOW TRAILER" HANDLER WITH WEB FIXTURE
II-10	SIDE LOADER
II-11	"PICKPOCKET "
II-12	STEINBOCK DEPOT LIFT
II-13	NORMAL EQUIPMENT - MATERIAL HANDLING - "LIGHT" LOADS, LOADING AND UNLOADING
II-14	MATERIAL CLASSIFICATION SUMMARY
II-15	MATERIAL HANDLING - "LIGHT LOADS/WEEK - CURRENT METHODS AND PROCEDURES

3. TRANSPORTATION EQUIPMENT

3.1	Review of Present Material Transport System	17
3.2	Review of Present Personnel Transport Equipment	20
3.3	Transport Vehicle Utilization Study	21

EXHIBITS:

- III-1 MID 1985 ASSIGNMENTS - TRANSPORT VEHICLE FLEET
- III-2 TRAFFIC SURVEY OBSERVATION POINTS
- III-3 TRANSPORT VEHICLE UTILITY

4. METHODS AND EQUIPMENT USED TO MOVE LIGHT LOADS OF MATERIAL AND PERSONNEL ONTO AND WITHIN SHIPS

- 4.1 Onboard Ship and/or Construction Unit25
- 4.2 Crane Activities.....28
- 4.3 Elevator Activities.....29

EXHIBITS:

- IV-1 ROL-A-CRANES FOR ON SHIP USAGE
- Iv- 2 HEAVY CRANE SURVEY
- Iv- 3 SUMMARY OF ELEVATOR OBSERVATIONS
- IV-4 SUMMARY OF STAIRWAY AND/OR GANGWAY OBSERVATIONS

5. PRESENT MATERIAL HANDLING COSTS

- 5.1 Equipment34
- 5.2 Personnel.....34
- 5.3 Perishable Items.. . . .136
- 5.4 Fuel Costs.....36
- 5.5 Total Estimated Annual Direct Cost of
Material Handling37

EXHIBITS:

- v-1 ESTIMATED ANNUAL COSTS OF MATERIAL HANDLING
EQUIPMENT FOR LIGHT LOADS (EXCLUDING CRANES)
- v-2 UTILIZATION OF FORK LIFT TRUCK FLEET
- V-3** TOTAL ESTIMATED ANNUAL DIRECT COST OF MATERIAL
HANDLING

6. STORAGE

- 6.1 Warehouse #1.....1.....38
- 6.2 Warehouse #.240
- 6.3 Warehouse #341
- 6.4 Yard Storage42
- 6.5 Harahan East Bank Warehouse44

EXHIBITS:

- VI-1a ALTERNATIVE METAL SKID
- VI-1b ALTERNATIVE STEEL PALLETS
- VI-2 GRADALL - LOED MUTLI-PURPOSE MATERIALS HANDLER
- VI-3 PETTIBONE EXTENDO
- VI-4 CHANGES TO THE FABRICATED PIPE STORAGE AREA WILL
INCREASE CAPACITY BY 67% OR REDUCE LENGTH OF PIPE
YARD BY 200 FT.
- VI-5 DOUBLE REACH FORK TRUCKS

7. MATERIAL FLOW ANALYSIS

- 7.1 General Material Flow.....47
- 7.2 Activity Areas47
- 7.3 Data Gathering47

7.4	Spread Sheet Compilation	48
7.5	Flow Analysis - Major Areas	49
7.5.1	Yard Storage Movements.. . . .	49
7.5.2	Warehouse Moves	55
7.5.3	Pipe Shop	58
7.5.4	Fabrication Shops, Platens 1,2,3, and Blacksmith Shop	59
7.5.5	Sheet Metal Shop and Roto-Blat Area	60
7.5.6	Machine Shop	61
7.5.7	Plate Shop.	62
7.5.8	Summary of Section 7 Recommendations	64

EXHIBITS:

- VII-1 OPERATION PROCESS CHART
- VII-2 BUILDING NUMBERS - ZONE'S 100-900
- VII-3 YARD ACTIVITY AREAS - MATERIAL MOVEMENTS
- VII-4(a)

MATERIAL SURVEY SAMPLE

- VII-4(b)

MATERIAL SURVEY SAMPLE

- VII-5 EXAMPLE OF SPREAD SHEET DATA FROM YARD STORAGE
- VII-6 SHIPYARD MOVEMENT SUMMARY - MOVES FROM FAB. PARTS
YD STORAGE
- VII-7 SHIPYARD MOVEMENT SUMMARY - FROM YARD STORAGE
INCLUDING PIPE
- VII-8 SHIPYARD MOVEMENT SUMMARY - COMBINED WAREHOUSE
MOVES-MAIN YD
- VII-9 SHIPYARD MOVEMENT SUMMARY - MOVES FROM THE PIPE
SHOP
- VII-10 SHIPYARD MOVEMENT SUMMARY - MOVES FROM UPPER YARD
FAB SHOPS
- VII-11 SHIPYARD MOVEMENT SUMMARY - MOVES FROM THE SHEET
METAL SHOP
- VII-12 SELF-LOADING - UNLOADING VEHICLES WITH
"QUICK-SWITCH" ATTACHMENTS
- VII-13 SURVEY FORM - PLATE SHOP FORMAT

8. PERSONNEL TRANSPORT ALTERNATIVE

- 8.1 Shuttle System65

EXHIBIT:

- VIII-1 PERSONNEL TRANSPORT ALTERNATIVE VAN SYSTEM ROUTE
SYSTEM

9. TOWER CRANE ALTERNATIVES

- 9.1 Potential Savings68
- 9.2 Additional Comments on Crane Conflicts74

EXHIBITS:

- IX-1 BARGE CRANE FOR LIGHT LOADS FROM "WATER SIDE"
- IX-2 EXAMPLE TOWER CRANE INSTALLATION

10.	OTHER VERTICAL TRANSPORTATION CONSIDERATIONS	
10.1	Personnel Hoists (Elevators)	77
10.2	Manlifts	77
10.3	Material Hoists	79
10.4	Escalators/Moving Belts	80

EXHIBIT:

x-1 "EXAMPLE OF A MANLIFT"

11.	STATE-OF-THE-ART / SHIP CONSTRUCTION/REPAIR	
11.1	Other U.S. Based Shipyards	82
11.2	State-of-the-Art Comments - General	82
11.3	Cable Cranes	85

EXHIBIT:

XI-1 LONG SPAN CABLE CRANE

12.	A CENTRALIZED TRANSPORTATION SYSTEM PROPOSAL	
12.1	Background	88
12.2	Charter of New Department	88
12.3	Estimated Savings	91
12.4	Implementation Schedule	92
12.5	Phase I	92
12.5.1	Site Selection	92
12.5.2	Facility Layout	92
12.5.3	Site Preparation and Facility Installation	93
12.5.4	Department Personnel Section and Manning	93
12.5.5	Night shift	94
12.5.6	Transportation Equipment Transfer	94
12.5.7	Activate Phase I of the Transportation Department	95
12.6	Phase II	95
12.6.1	Department Personnel Selection and Manning	95
12.6.2	Activate Phase II of the Transportation Department	96

EXHIBITS:

XII-1 CENTRALIZED TRANSPORTATION SYSTEM ANNUAL COST SAVINGS (ESTIMATE)
XII-2 ORGANIZATION CHART - CENTRALIZED TRANSPORTATION SYSTEM
XII-3 "GENERAL SITE LOCATION FOR TRANSPORT VEHICLES"
XII-4 PROPOSED RELOCATION OF GAS PUMPS AND PROPOSED PARKING AREA
XII-5 ANNUAL COST SAVINGS ESTIMATES

FOREWORD

This document gives the results of a 1985 study performed at Avondale Shipyard. The study is, in part, a response to an industry priority set forth in accordance with the National Shipbuilding Research Program under the auspices of the Merchant Marine Act of 1970: to improve shipbuilding productivity and reduce shipbuilding costs while maintaining requisite high standards for critical processes and operations.

The primary objectives of this project are-to:

Study the present methods and equipment used to move personnel and light loads at Avondale's main yard.

Document the present methods being used.

Develop plan(s) for new methods and/or equipment to reduce overall costs.

The results of the study are that both short and long term improvements in productivity and cost reduction have been identified. These are being and will be implemented.

Many of the recommended changes could be applicable at other U.S. shipyards, although differences in yard layout, type of ship work, etc., would determine what would be achievable.

This project is one of many now jointly funded by the Department of Transportation, Maritime Administration and the United States Navy, cost shared by Avondale Shipyards, through SNAME Panel SP-1 Shipyard Facilities and Environmental Effects.

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Outside consultant assistance was provided by E. J. Phillips, Senior Consulting Associate, C. Hi James, Senior Consulting Associate, and N. L. Hannon, Senior Vice President, THE LEAWOOD GROUP, Richard Muther & Associates.

1. EXECUTIVE SUMMARY

1.1 The Purpose of This Project

The basic purpose of this project is to determine the cost of the present methods of moving light materials and people between yard operations and on and off ships, and to develop new methods and/or equipment to reduce the high cost of these functions.

1.2 Objectives

The objectives of the study are to:

- a. study the present methods and equipment used to move personnel and light loads at Avondale's main yard.
- b. estimate the cost of the present methods of moving personnel and light loads.
- c. develop plan(s) for new methods and/or equipment to reduce costs.

1.3 Scope

The study project includes the main yard of Avondale Shipyards located along the west bank of the Mississippi River near New Orleans, Louisiana, as shown in Exhibit I-1.

A brief review of the east bank warehouse located in Harahan, across the river from the main yard, was also included with respect to material transportation between the two locations.

1.4 Meaning of "Light Loads"

It was necessary at the beginning of the project to arrive at a working definition as to what was meant by the term "Light Loads." Two factors emerged as being key in defining the term:

- a. bulk and/or shape
- b. weight

The predominant factor is bulk and/or shape. Weight enters the definition (as a modifier) and is not a final determinant of a light load. It is only a refining and limiting factor with respect to existing materials handling equipment and/or the specification of new equipment.

The total number of personnel required to hook/unhook and/or manipulate the load, bearing in mind the above two factors, gives a broad definition of light and/or heavy loads. For example, for yard only movements;

if one man is required to perform the handling operations (2 if a crane operator is involved), the load can be classified in the light category.

should more than one man be required (3 or more in the case of crane operator involvement), then the load may be considered in the heavy category.

Exceptions to these criteria undoubtedly occur, but for general shipyard practice, this practical definition will cover the majority of material handling situations. This study was limited to individual transported loads under five tons and crane loads under ten tons. For the purposes of surveying crane usage, heavy loads were considered as one category and light loads (using the small "hooks") were considered as another category.

1.5 Exclusion: Plant Engineering and Maintenance Use of Vehicles

This category was specifically excluded from the current project. Because of the size of this portion of the vehicle fleet, it is considered that a similar study based on that vehicle usage alone could result in substantial additional savings.

1.6 Summary of Conclusions and Recommendations

This project was done as a case study at Avondale, to which the findings and recommendations are directly applicable. The same principles of analysis and concepts could be applied at any U.S. shipyard.

- a. Total estimated 1985 direct cost of materials handling is running at a yearly rate of just over \$9.7 million.
- b. The formation of a centralized transportation dispatching department could save in excess of \$325,000 per year.
- c. A smaller, similar transportation/utilization study should be performed on the plant engineering/maintenance vehicle fleet. Additional savings are likely.
- d. A review of the present utilization and policy of portable radio usage within the yard is recommended. Less expensive alternatives or combination of alternatives may be available.

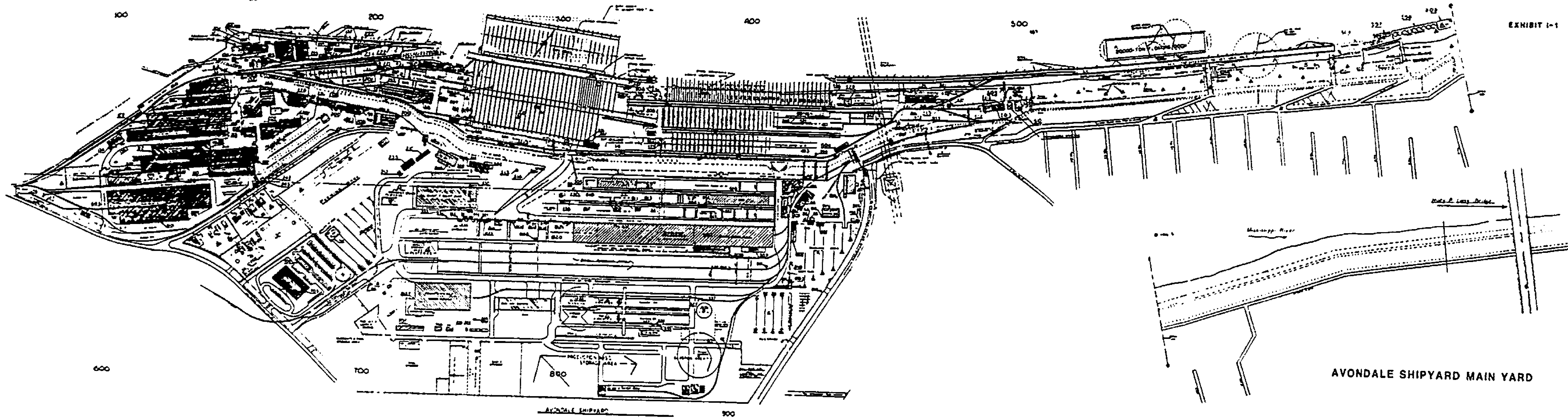
- e. On average, each motorcycle on site makes less than one round trip per day on the levee road. The company's policy with regard to the distribution of motorcycles could be re-evaluated. An alternative van- type central shuttle bus system could be considered. Savings up to \$91,000 per year could be achieved by the elimination of half the motorcycle fleet.
- f. A zoned staging sequence for below-deck scaffolding should be implemented. One of the biggest problems affecting material handling on board ship, particularly with conversion projects, is the current practice of flooding below deck areas with too many scaffold installations. This makes it difficult to use any type of mechanical aid for material handling. A separate, detailed study on staging systems is currently underway.
- g. Personnel hoists (elevators), as currently used, are warranted and justified in hi-rise shipyard situations.
- h. The use of tower cranes for ship work is recommended:
for shipbuilding these should be either ways-mounted or on-ship mounted as appropriate to give lifting cover and avoid interference with the Whirleys.
for repair or conversion work it would appear that on-ship mounting would be the most applicable.

Tower cranes are recommended over the use of material hoists or material handling elevators. Avondale has been using some tower cranes for a number of years. The installation of additional tower cranes could save in the order of \$580,000 per year. A separate tower crane study by Avondale should be complete by June, 1986.

- i. Approximately \$300,000 is spent per year on replacement of wooden skids. Use of metal or plastic skids alternatives should be evaluated by Avondale. Considerable savings over the long term may be achievable.
- j. Fork lift runner channels should be installed on the bottoms of all new lock boxes so that wooden pallets are not required.
- k. The area required for fabricated pipe yard storage can be reduced significantly with new handling storage equipment.
- l. The Harahan warehouse across the river is maintained on a short-term lease to meet current needs. If it were to be kept on a permanent or long-term basis, it would be worth investigating an alternative equipment and racking scheme. Space utilization could then be increased considerably in some areas.
- m. The concept of leaving flat bed trailers at various

locations around the yard for storage until full works fairly well at Avondale. However, it could be more cost effective to load and unload the trailers, reduce the trailer fleet, and reduce maintenance and depreciation costs.

- n. The purchase of a Gradall "Loed" type material handler will reduce the yard jockey fleet by two vehicles and save approximately \$30,000 per year. One vehicle with the proper attachments will satisfy 70% of all yard storage material movements at the mid 1985 year capacity level.
- o. The use of mule trains was started at Avondale some 8 years ago, after seeing them in action at NASSCO. They work well. Two 12 car mule trains will handle most of the material transport requirements of the main yard warehouses, the sheet metal shop and the roto-blast area.
- p. Cable cranes have been studied in the past, and could be looked at again in the future to evaluate the practicability and value of using long-span cable cranes for shipyard use. These offer high flexibility for loads up to 9.5 tons over nearly 1,000 feet span. However, safety during installation of these units must be of primary concern.



2. PRESENT MATERIAL HANDLING SYSTEM WITHIN THE SHIPYARD

2.1 Overall Light Equipment Control

A mixture of equipment control procedures is currently in effect at Avondale.

The pickup and set down of most light loads is performed by lift trucks in the 4,000 to 8,000 lb. capacity style. A relatively new control system for the yards fifty-six (56) fork lift vehicles is operated using a combination of centralized and decentralized control. The fork lifts are assigned to one (1) of eight (8) separate geographical sectors of the main yard as shown in Exhibit II-1. In each specific sector, the lift trucks are generally under the control of the individual area production or warehouse superintendents. However, a lift truck coordinator, who reports directly to the Group Vice President of Production, can temporarily pull idle trucks from any area for use in another area if production needs so dictate. These operations are handled via telephone and portable radio communications between users who urgently need the lift trucks and the coordinator. This system has recently been implemented in an effort to increase utilization of the existing fork lift truck fleet.

Most of the remaining vehicular yard light load transport equipment (with the exception of the mule trains) falls under the jurisdiction of the material control department. This equipment, for the most part, consists of over-the-road tractors/cabs, stake body trucks, flat bed trailers, side

loaders, pickup trucks, a portable crane and yard-only tractor/cabs. See the equipment list shown in Exhibit II-2.

Four (4) pickup trucks and four (4) stake body trucks are consigned to the main warehouse dispatching function. In addition to performing material dispatching from the yard "warehouses, these trucks are on call (on a first call, first service basis) throughout the yard, based somewhat on location. However, unlike the fork truck fleet, these trucks return to the general warehouse area when not on a yard call. One (1) pickup truck is assigned continuously to picking up materials away from the yard in the general metropolitan area.

The majority of the remaining transport vehicles for light loads are assigned to the outside material location control function which is also responsible for all outside yard storage. This function coordinates the transport of piping, fabricated parts, electrical cable, oil/grease, etc., throughout the yard.

When the various shops or platen areas have enough finished work accumulated and the work is ready to be sent to the next location or operation, a call is made to the material control group requesting a transport vehicle. These calls are prioritized by the material control function based on a first call, first service basis. Two (2) stake body trucks are assigned continuously, one (1) each to the pipe shop and plate shop, respectively. Even though these trucks are theoretically under the control of the material control function, they are in

essence an extended arm of the production shops. In a similar fashion, flat bed trailers are assigned to specific areas for production usage. Four (4) trailers are assigned to the plate shop, one to two (1 to 2) to the sheet metal shop, one to two (1 to 2) to the fabrication shops, etc.

Some logistic problems may develop if loaded trailers are not unloaded in a timely fashion. In effect, loaded trailers can become work in process storage areas if not handled properly. This situation can become aggravated if, for example, the plate shop plans to work overtime on weekends. If this happens, it is essential that enough empty trailers be available for the plate shop to eliminate tying-up magnetic cranes in double handling of materials.

The transport function is actually split between three (3) areas:

Light loads: a. Material Control - Yard Storage

b. Material Control - Dispatching

Heavy loads: c. Crane Department

The crane department (which was not part of this project) uses mostly rental equipment - portable cranes, large bed trailers, cherry pickers, front end loaders and large fork trucks. The large transporter and small "Yellow Trailer" transporter currently being used are owned by Avondale.

If a stake body truck or pickup truck is required for a move, the dispatching department is called. If a standard flat bed trailer is required, the yard storage department is

called. If a heavy transporter or portable crane is needed, the crane department is called.

In addition to the above equipment used for material handling and transportation, warehouses #1 and #2 also employ "Pickpocket" side loading pallet picking (and storing) high fork lift trucks and a Steinbeck depot high fork lift truck. Two (2) 400 pound capacity economy lift mechanisms and one (1) 6,000 pound capacity side loader are also used in warehouse #1. This warehouse equipment is generally restricted to inside use and is under the direct control of the warehousing function.

A mule train type tractor pulling a dozen or so small trailers is used for transporting blasted and painted parts to the yard storage area. This production function also uses a multi-pallet lift truck that can load up to three (3) pallets on its own support body. This truck is used primarily for paint distribution throughout the site. However, the truck does fall under the jurisdiction of the centralized lift truck coordinating function.

Movement of material within and from other individual shops onto outside transport vehicles is handled by a number of methods. These methods include a combination of manual labor, overhead or portable crane and fork lift truck depending on the size and/or weight of the load. These moves are generally under the control of the individual shop superintendents. Exceptions are the loading of piping materials to transport vehicles at the pipe shop and the marshaling of field pipe

details (in locked containers) at warehouse #2. These loading operations are physically handled and controlled by the material control organization with personnel from the pipe shop checking the shipment loads. See Exhibits II-3 through 11-12 for photo examples of equipment.

2.2 Transport Equipment and Containers

A "normal" listing of material transport equipment was charted showing the main shops and warehouse shipment usage. This chart is shown in Exhibit II-13. The chart should be looked upon as the listing of equipment used for over 95% of all transport work for light loads.

The infrequent use of portable cranes or other special transporter equipment has not been included. These are seldom used by the major shop areas for actual transport purposes at the present time. The small 50 ton capacity "Yellow Trailer" transporter is used on an average of 2 to 3 times per day by the various platens on the south side of the levee. This is pulled by a large specially designed Kalmar fork lift truck.

Containers in general usage today are of five (5) main types:

- a. Pickling tub - used to transport pipe from the pipe shop to the pickling area.
- b. two (2) types (large and small) of steel cradles (baskets) for handling the shipping of pipe details from the pipe shop to the blast and paint areas and/or the yard storage areas.

- c. Two (2) types of wood pallets -4 ft. x4 ft. and 4 ft. x 8 ft. in plan size. These are heavily used throughout the site to facilitate fork truck handling of piece parts.
- d. Special racks and/or beds for the "Yellow Trailer".
- e. Metal lock boxes for small field-marshalled pipe details.

2.3 Light Load Weights

Most light loads being moved throughout the yard are handled on wood pallets or skids and are under 600 pounds. Well over 90% of all light loads are handled by 6000 lb. to 8000 lb. capacity fork lift trucks. One notable exception is the plate shop where approximately 41% of all vehicle loads are handled by crane.

Sample weights taken on full yard stored pipe baskets indicate gross average weights of 5350 lb. per large basket with a *7700 lb. maximum. Sample weights taken on full small baskets indicate average gross loads of 2100 lb. with a 2600 lb. maximum. Estimated stake body truck loads coming from the pipe shop indicate average loads of 10,000 to 14,000 lb.

In comparison to the pipe shop, stake body truck loads coming from the plate shop are only averaging 2350 lb. with an 8000 lb. maximum load. Loads heavier than 5000 lb. are generally moved by flat bed trailer. Trailer loads are averaging approximately 11,700 lb.

*NOTE: The 7700 lb. maximum weight was found on a half full basket of 4 inch diameter, densely packed, straight steel pipe.

2.4 Material Classifications

The attached material classification summary as shown in Exhibit 11-14 has been developed for light loads at Avondale. This listing has been used for data collection purposes only. It is used for quantifying the number of material handling moves, the types of materials being moved, and the approximate size and/or weight of the items moving.

2.5 Light Load Movements

Based on data collected during the period June 18 through July 19, 1985, the average number of weekly trips and amounts of material moving was established. These data were compiled by transport vehicle and major point of loading and are shown in Exhibit 11-15.

2.6 Light Load Warehousing Area Dispatching

The various warehousing dispatching functions were observed as part of the project data collection phase.

The dispatching of underroof storage items is generally coordinated at warehouse #1. All paperwork receipts of material are centralized at this warehouse. Special items or large items such as raw pipe, paint, consumables, etc., are taken direct to their particular storage points. However, the official receiving paperwork is handled by the receiving function in warehouse #1.

Two (2) warehousing personnel start work at 4:00 a.m. each morning. They stage material (for dispatching at 7:00 a.m.) and place incoming materials, which were received the previous

day, in multi-tier pallet racks. The great majority of rack stored items are on 4 ft. x 4 ft. wood pallets with a total height not exceeding 44 inches. Additionally, these pallet loads cannot weigh more than 4150 lb. alone or 8300 lb., side by side, as that is the loading limit of the racking structure.

Materials on pallets are removed from the pallet racks and taken directly to the dispatching area. The procedure is as follows:

- a. The material is picked from its location, usually using a narrow aisle "Pickpocket" truck. This equipment handles only 4 foot square skids in its normal operating mode. Longer skids are handled by a standard fork lift truck in pallet racks facing wide aisles.
- b. The "Pickpocket" sets the pallet down at the end of the storage aisle on a raised pedestal of empty skids.
- c. A standard fork lift truck picks the pallet up and moves it to the dispatching area.
- d. The fork lift truck sets the material down in the dispatching area.
- e. The dispatching coordinator (not either of the people involved in a,b,c, or d above) looks over the material and where it should go. He assigns each pallet to a particular truck. There may be some moving of small items at this point to consolidate them for a particular pallet destination.

- f. A fork lift truck then picks up the pallets and moves them-to the assigned trucks.
- g. The pallets are placed on the individual trucks.
- h. When the coordinator feels the individual trucks are ready to go to the various stops, he releases them.

For the remainder of the day, the coordinator takes telephone calls for yard moves, along with coordinating additional pallet dispatching. Eight (8) trucks are available for use by the dispatching function.

All of the dispatching trucks, which begin the day at 7:00 a.m., return to warehouse #1 at the end of the shift.

A two (2) week survey was made in June, 1985, of the pallets available for the (usually) seven (7) truck drivers at the 7:00 a.m. dispatching event. An average of nine (9) pallets were available for eight (8) trucks with a minimum of two (2) pallets and a maximum of sixteen (16) pallets.

A one (1) week sample survey of reported driver times for unloading vehicles indicated that drivers are spending 3 to 4 hours per day, during the unloading cycle, waiting.

2.7 Truck Dispatch System

Two (2) methods are now used by the material control function for communication of dispatch instructions.

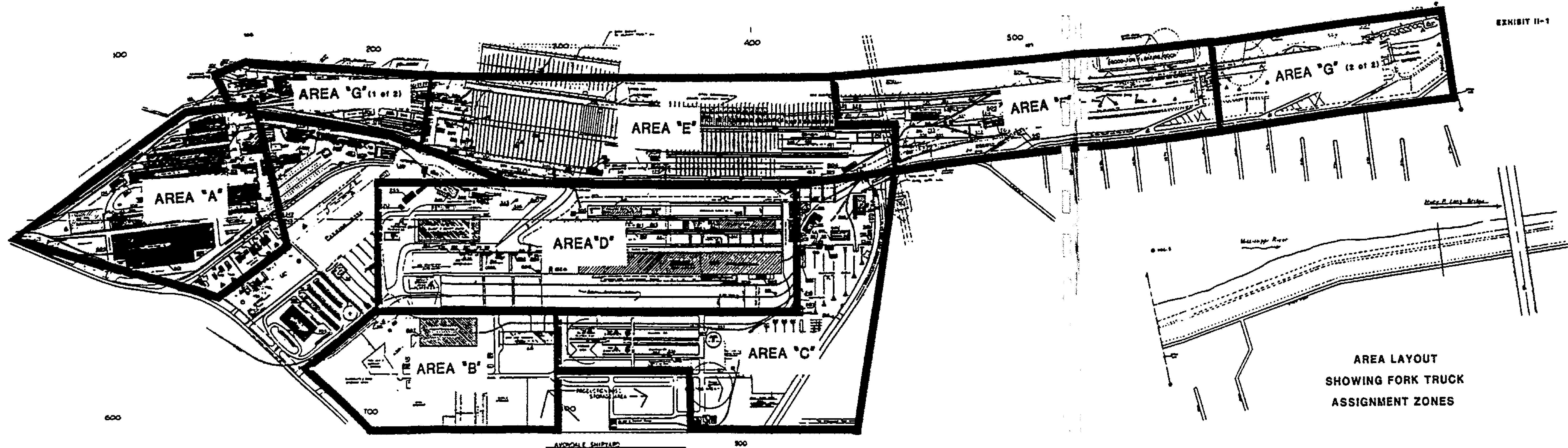
Of the eight (8) trucks currently assigned to the warehouse area, six (6) are equipped with truck-mounted two-way radios. These trucks, and the two non-radio-equipped trucks are controlled from the dispatching office located in warehouse

#1. A base station two-way radio is installed in the warehouse dispatching office for this purpose.

The other main material control function is located in the yard storage area. The major portion of their work is centered on delivering yard materials per the production schedule. Back hauls are made, for the most part, by telephone communications from areas which have a loaded trailer ready for movement to sandblast, yard storage, etc. Their dispatch instructions are now communicated by an assigned person who delivers verbal and written instructions via the use of a motorcycle.

Every individual truck in the yard's fleet was not examined to determine how many were radio equipped. However, a review of the asset list shows a substantial amount of radio equipment in the yard. For example, the August, 1985 asset list shows over one hundred (100) portable radios such as Motorola's "Handie Talkies" and "alkie Talkiest" are on site. However, we were unable to determine exactly how many of these, if any, are used in directing horizontal transportation equipment other than the ones supervised by the material control functions as specified above.

Although not included as a part of this study, we recommend that Avondale review its' present utilization and policies with regard to portable radio usage within the yard. Less expensive alternatives or combination of alternatives may be available.



EQUIPMENT LIST - LIGHT LOADS

1985 MATERIU EANDLING EQUIPMENT

Pickup Trucks

Stake Body Trucks

Flat Bed Trailers

Fork Lift Trucks:

Warehouse Type

Rough Terrain Type

Multi Pallet Lift

Economy Lifts

Steinbeck Unit

Pickpockets

Cherry Pickers

Yard Jockeys

Yard Tractors

Mule Train Tractor

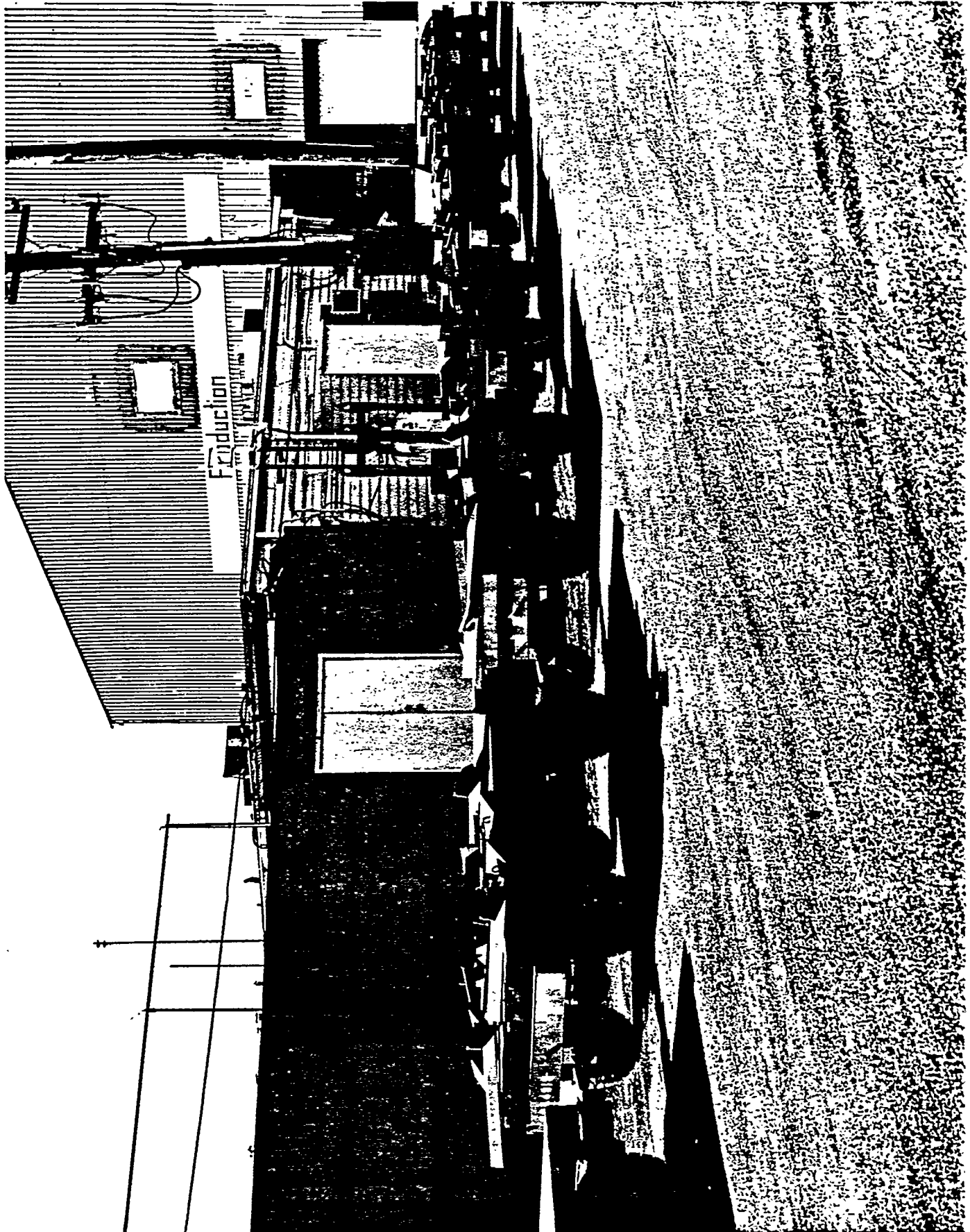
Mule Train Trailers

Side Loaders

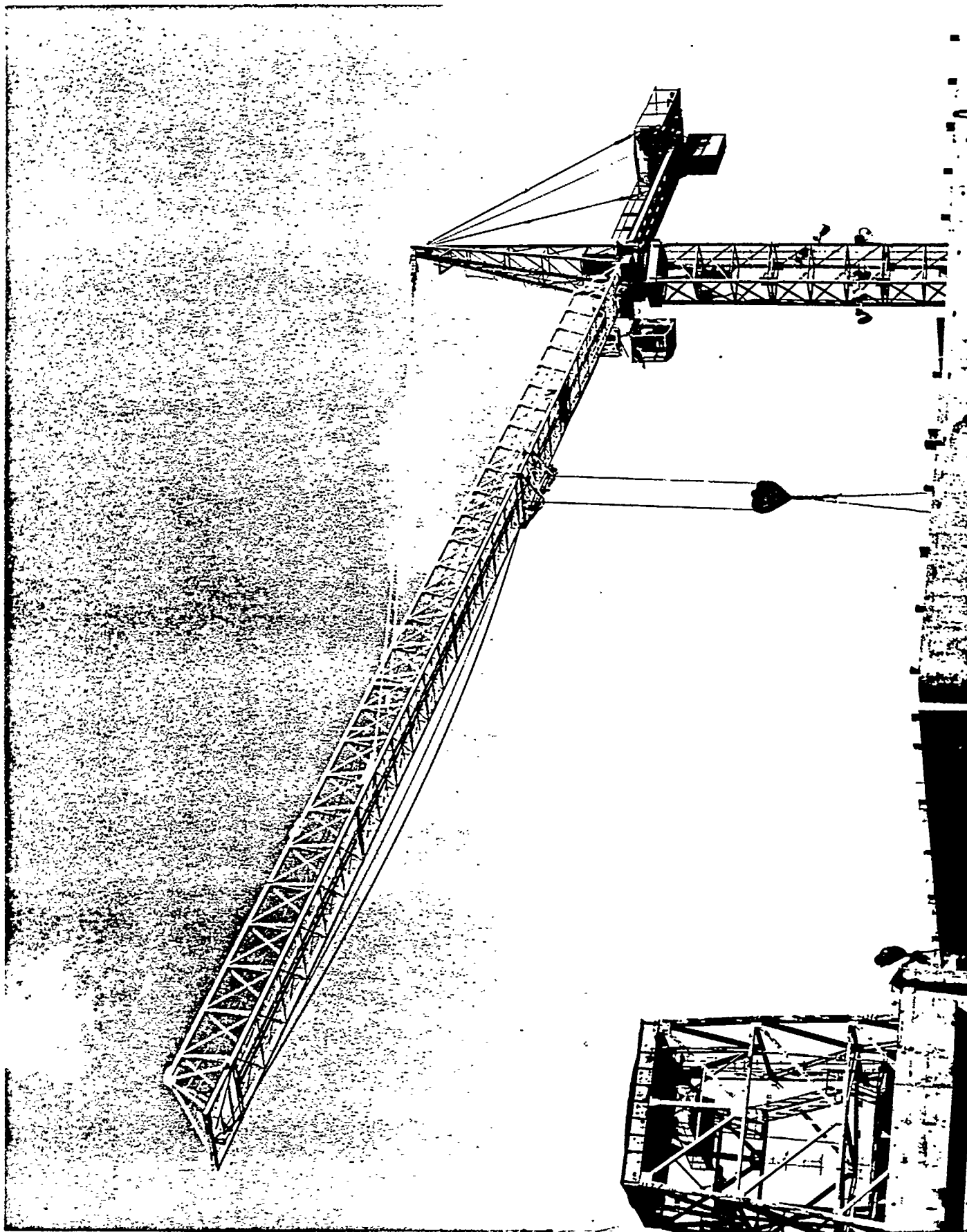
50 Ton Transporter

NOTE: Does not include cranes or vehicles/equipment assigned to - Plant Engineering and Maintenance, cafeteria, Security, Personnel, Engineering or Westwego Yard.

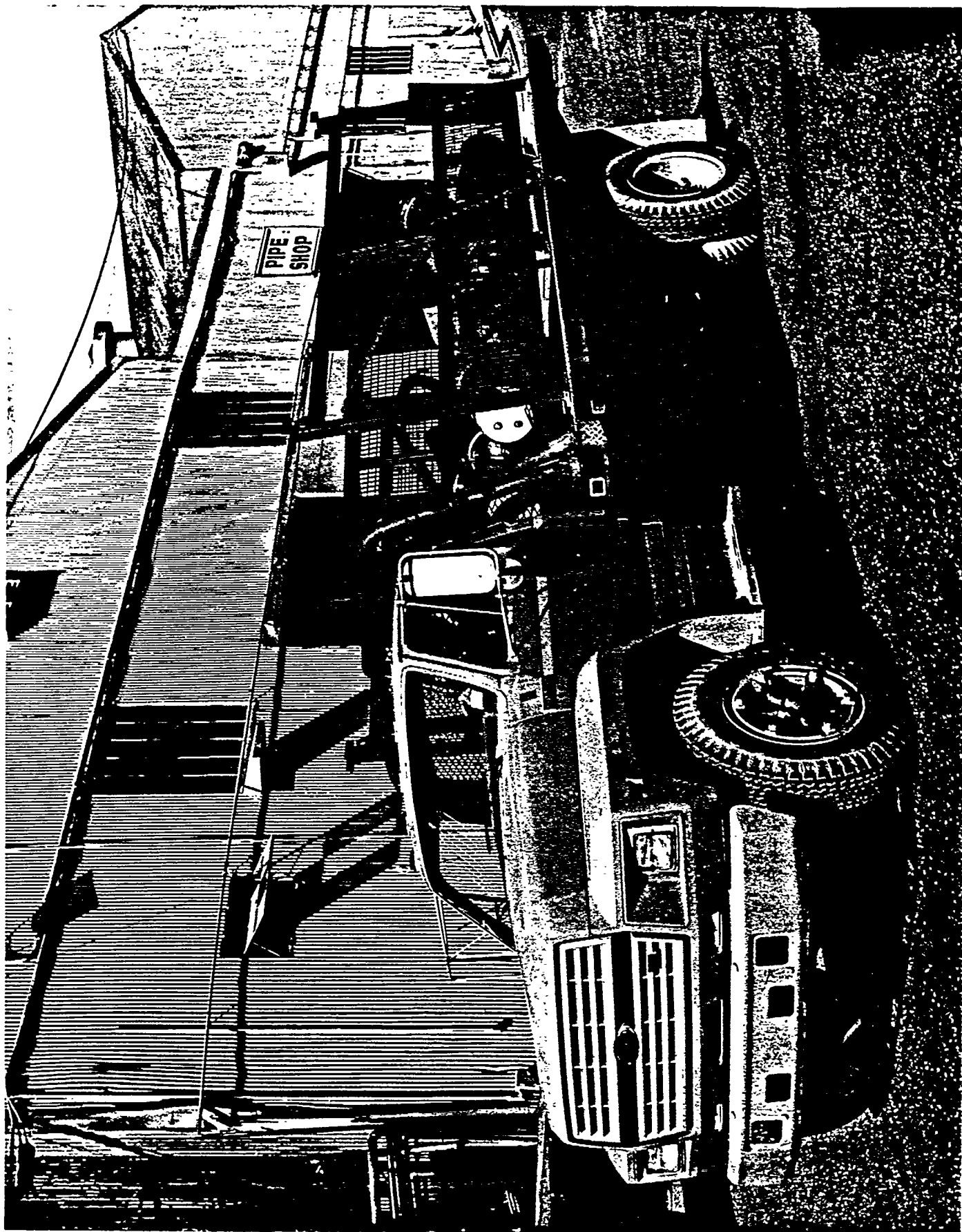
AVONDALE "MULE-TRAIN"



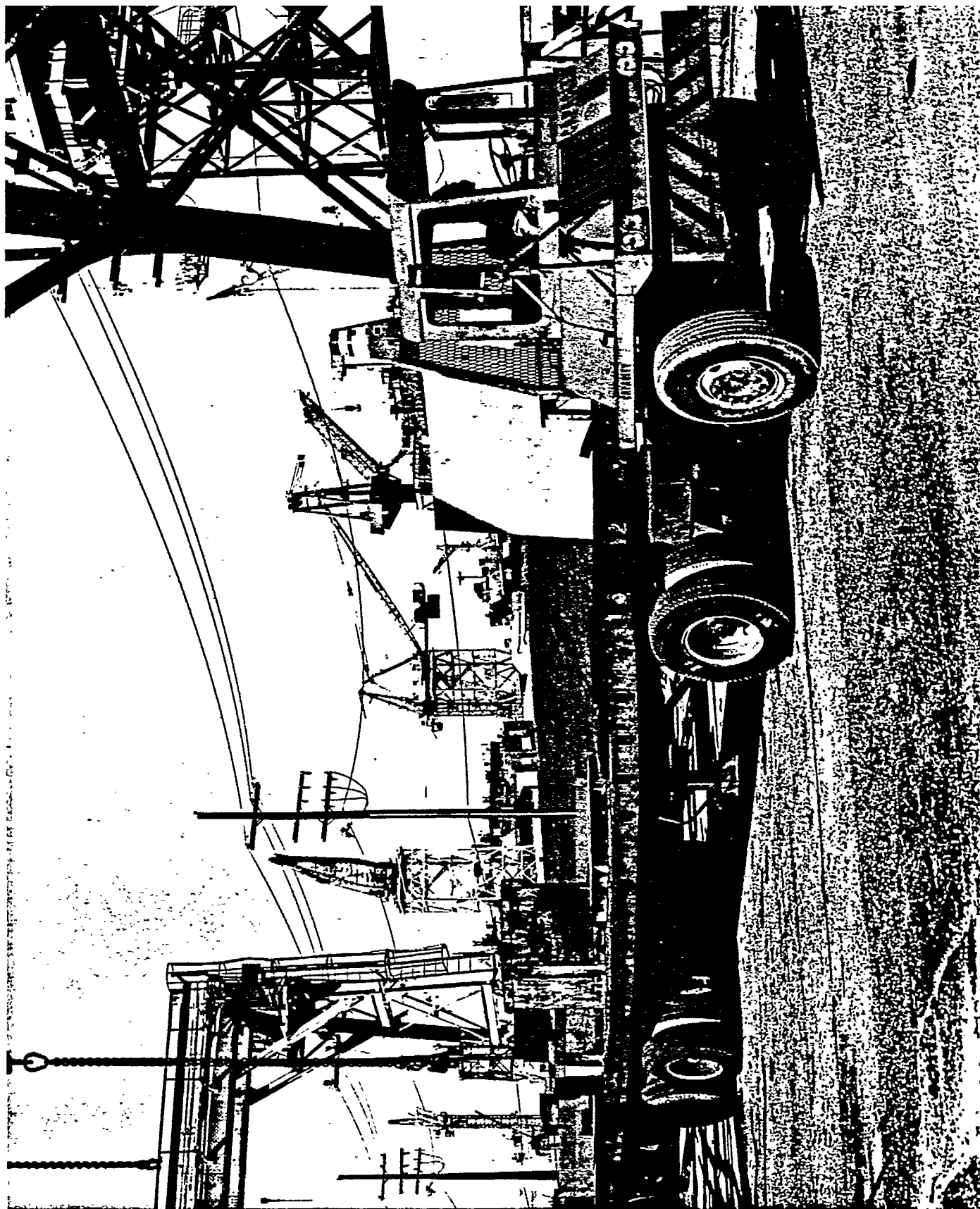
TOWER CRANE



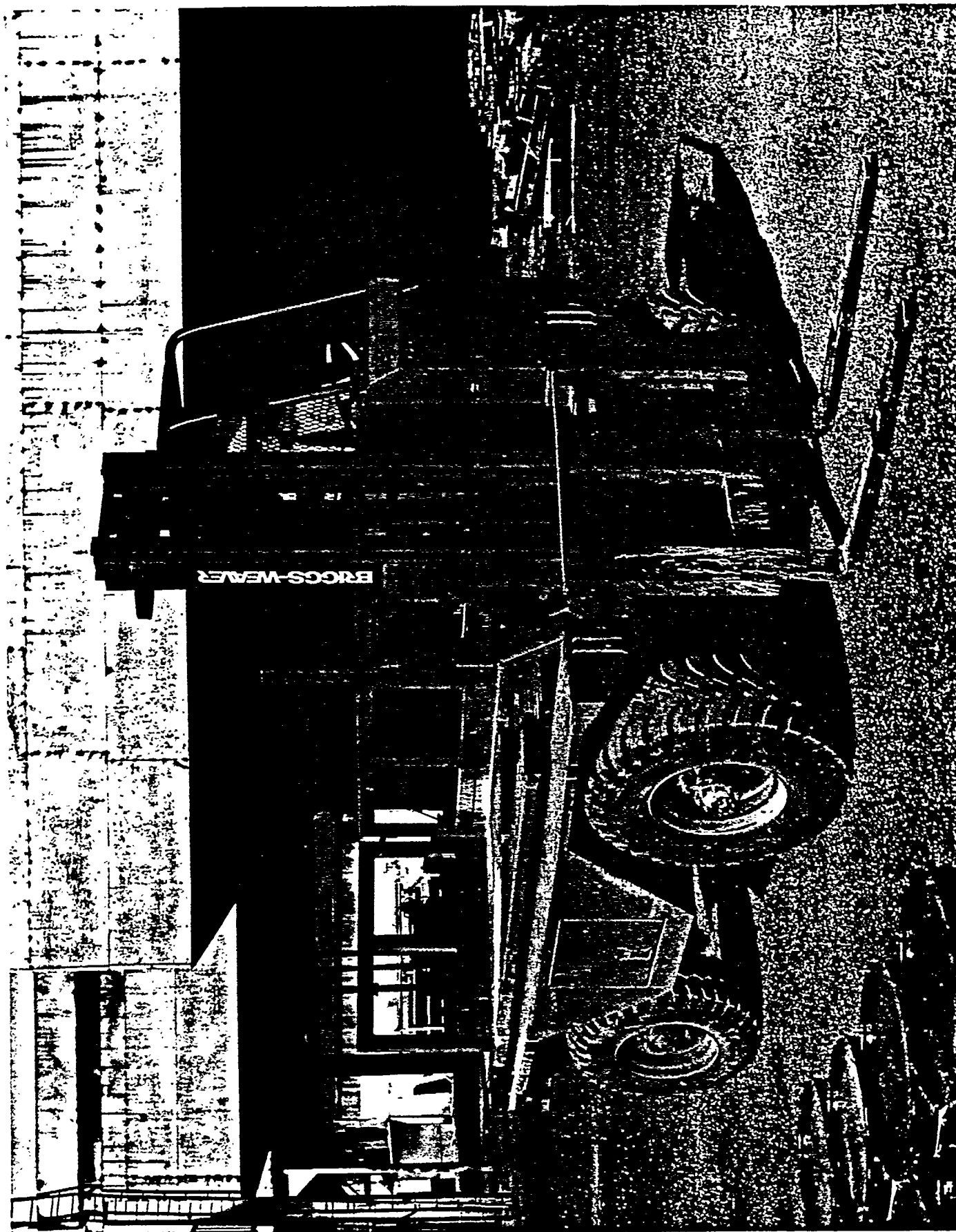
STAKE BODY TRUCK WITH PIPE BASKETS



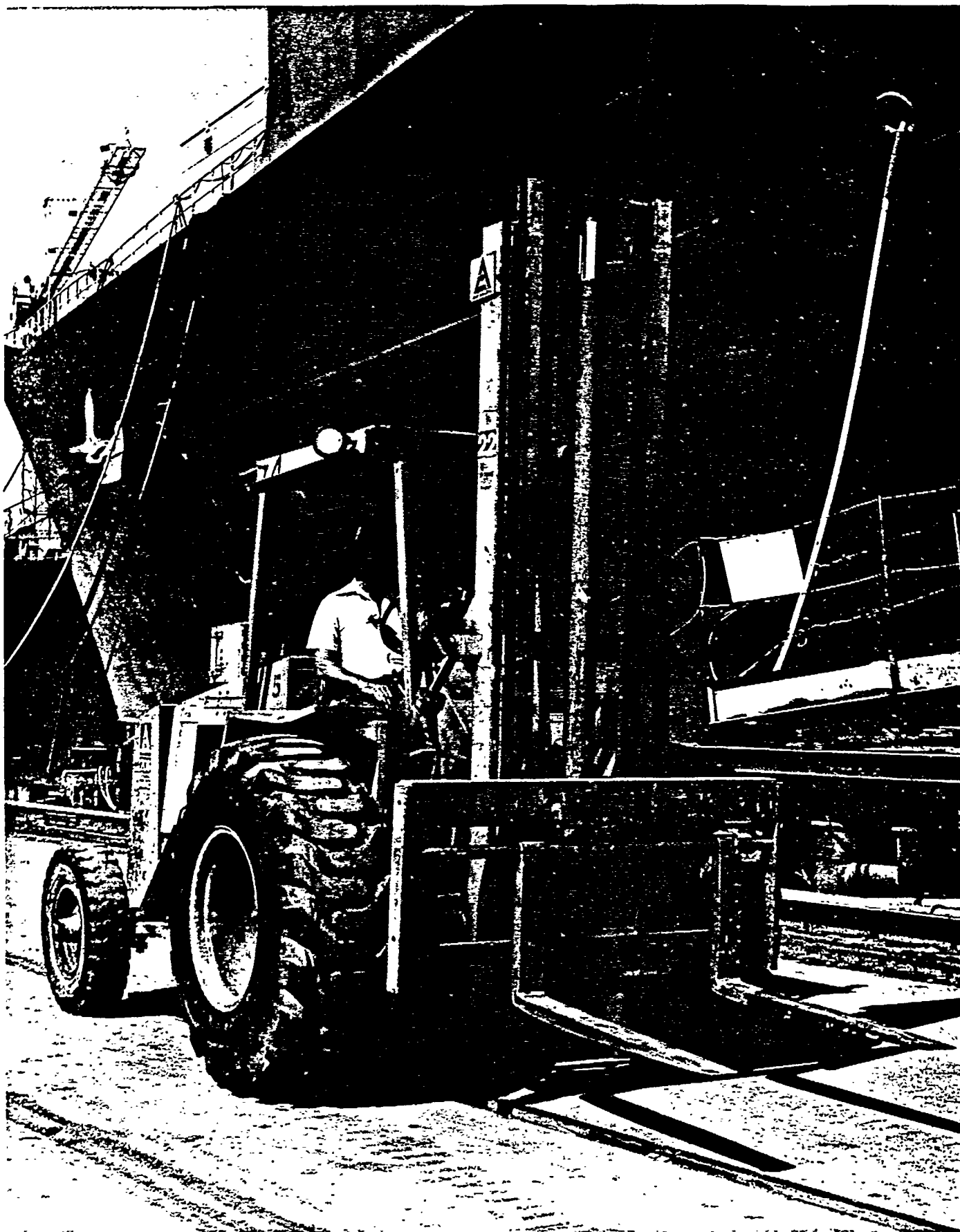
FLAT BED TRAILER PULLED BY YARD JOCKEY



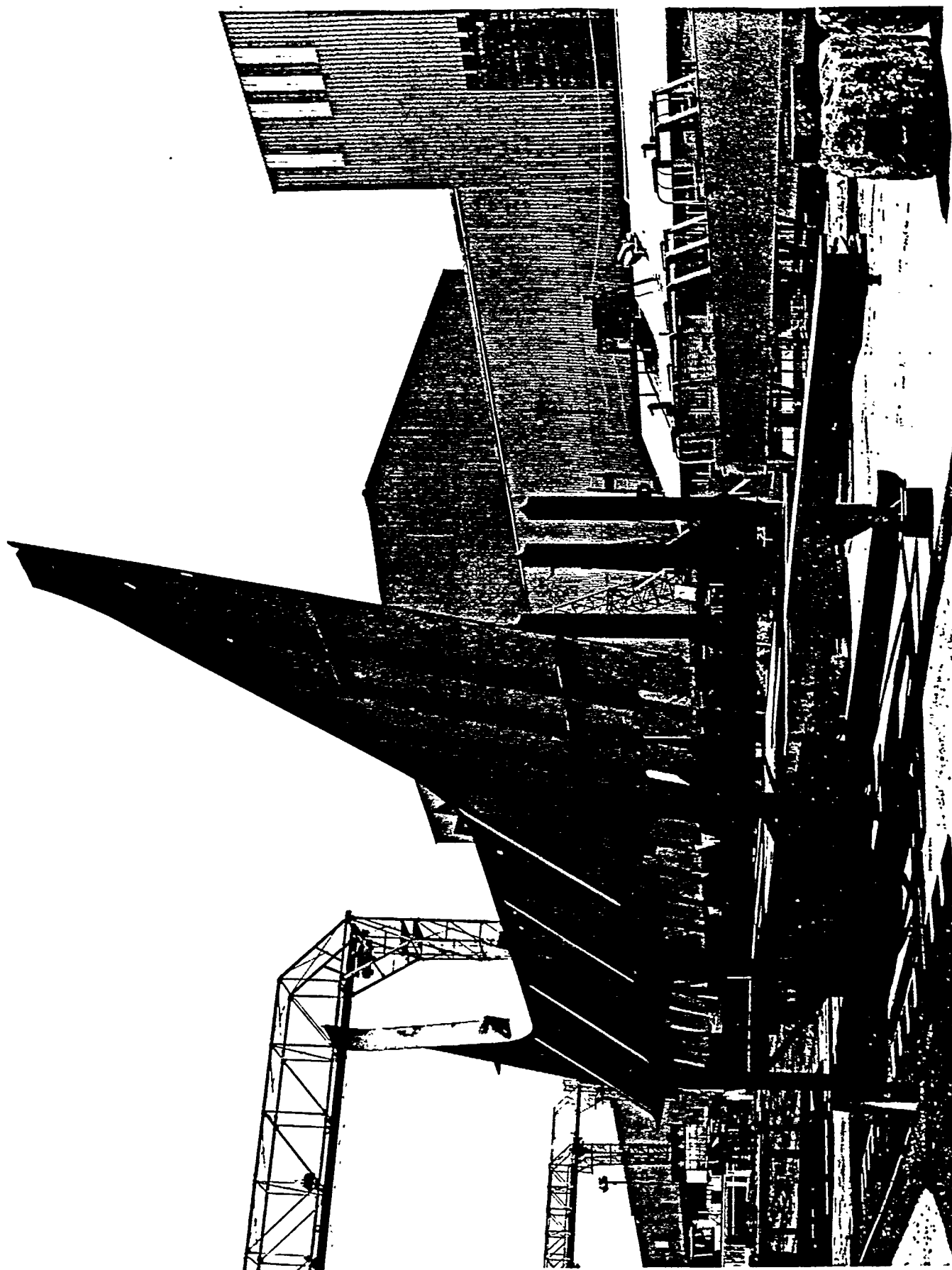
MULTI-PALLET SELF LOADING LIFT TRUCK



TYPICAL 6000 LB. CAPACITY FORKLIFT TRUCK



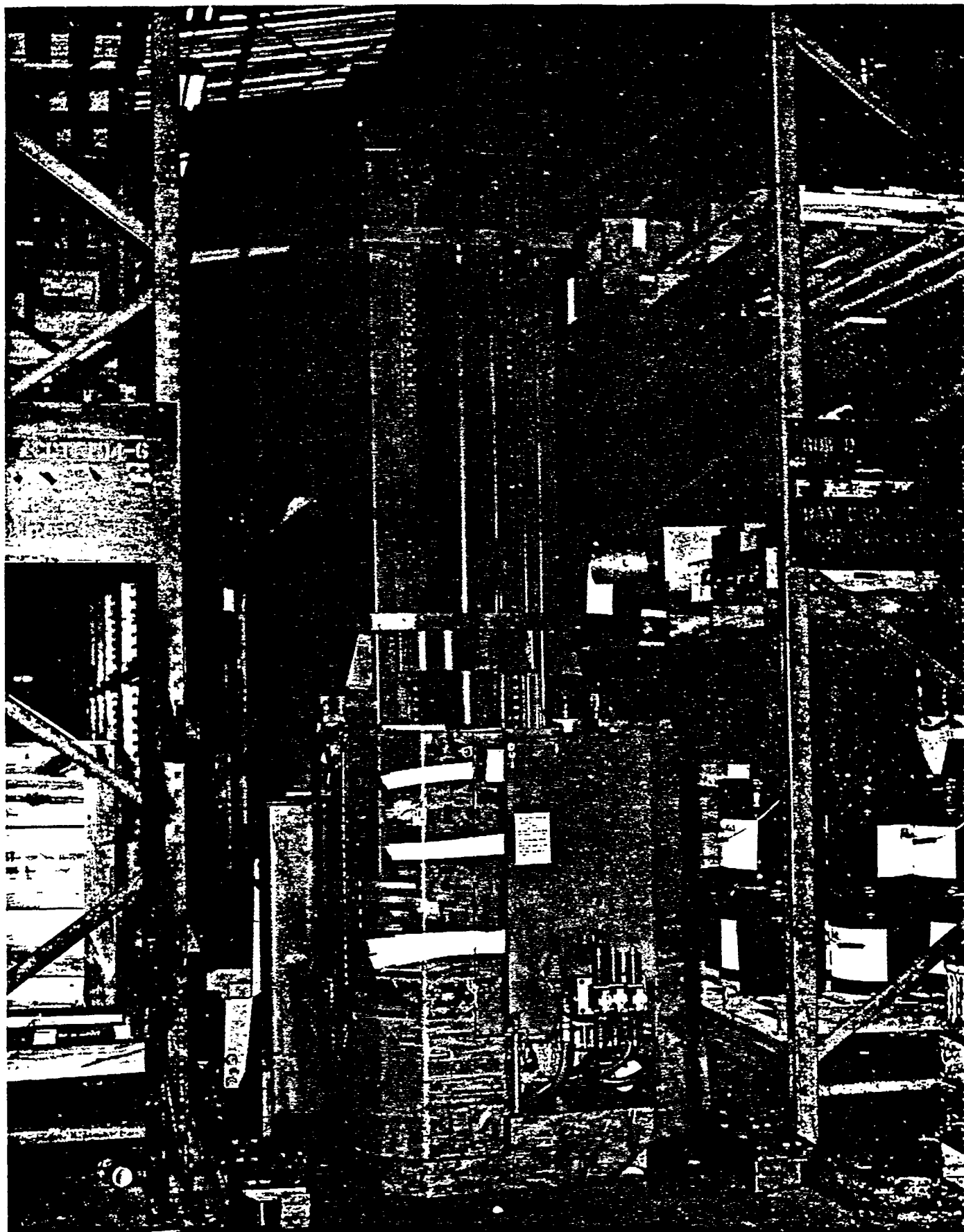
"YELLOW TRAILER" HANDLER WITH WEB FIXTURE



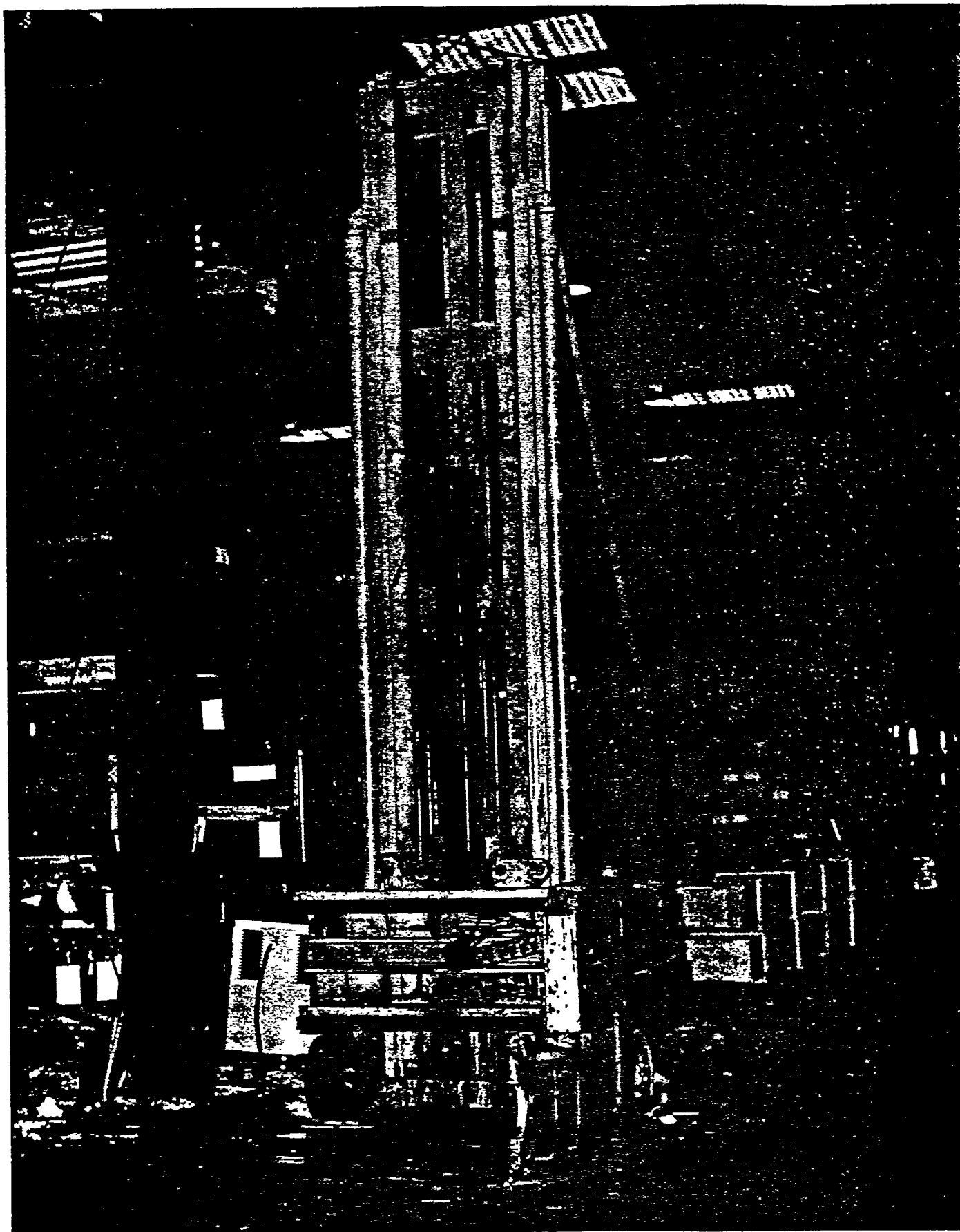
SIDE LOADER



"PICKPOCKET"



STEINBOCK DEPOT LIFT



NORMAL EQUIPMENT
MATERIAL HANDLING - "LIGHT" LOADS
LOADING AND UNLOADING

NORMAL LOAD/UNLOAD EQUIPMENT	WHSE. #1	WHSE. #2 & #3	PLATE SHOP	FAB'D PARTS YARD STORAGE	PIPE SHOP	MACHINE SHOP	SHEET METAL SHOP	FAB SHOPS	BLAST & PAINT
MAGNETIC CRANE			✓ (10-17 1/2 Ton)						
4000# FORK TRUCK	✓	✓							
6000# FORK TRUCK (Multi-Pallet Trk.)	✓	✓	✓	✓	✓	✓	✓	✓	(✓✓)
8000# FORK TRUCK			✓	✓	✓				
6000# SIDE LOADER	✓			✓					
BRIDGE CRANE	✓ (5-25 Ton)				✓ (5-20 Ton)	✓ (15-20 Ton)			
PORTABLE CRANE (Cherry Picker)				✓ (18 Ton)					
OTHER CRANE								✓	✓

NOTE: Platen areas loaded/unloaded via 6000#/8000# fork trucks and/or Gantry cranes.

MATERIAL CLASSIFICATION SUMMARY

Plant Avondale Shipyards/Main Yard Project RMA 85329
 By E.T.P. With _____
 Date June 13, 1985 Sheet 1 of 1

MATERIAL CLASS		CLASSIFICATION CRITERIA		TYPICAL EXAMPLE
Description	Class. Identif.	Physical Characteristics (Size, Weight, Shape, Risk, Condition)	Other Characteristics (Quantity, Timing, Special Control)	
1 Raw & fab'd pipes before surface treatment	A ₁ A ₂	Mixed short and long pipes - bent and unbent up to 7500 lbs. in total weight	May require different container/control for: 1) blast and paint 2) pickle	----
2 Finished painted pipes after surface treatment	B ₁ B ₂	Mixed short and long pipes - bent and unbent up to 7500 lbs. in total weight	1) Uncontrolled - single or batch quantities 2) Controlled "pallet" quantity	----
3 Small hardware and piece parts	C	Loose, bagged, or boxed in containers < 1 ft ³ in size	Up to 20 lb.	Bagged nuts, bolts, washers, etc.
4 Medium hardware and piece parts	D	Loose, bagged, or boxed in containers > 1 ft ³ in size	Up to 50 lb.	Flourescent light bulbs, small elbows, "T's", valves, etc.
5 Mechanical/electrical components (medium sized)	E	Up to 4 ft x 8 ft x 40 inch high. Suitable for handling on standard pallet	4' x 4' < 4150 lb. > 50 lb. 4' x 8' < 8300 lb.	Medium valves, pumps, fans, elbows, etc.
6 Mechanical/electrical components (large size)	F	Over 4 ft x 8 ft x 40 inch high. Bulky and/or difficult to handle with lift trucks	Up to 8,000 lb.	Large motors, valves, pumps, fans, elbows, etc.
7 Small structural steel members-angles, channel, rod, etc.	G ₁ G ₂	Relatively small cross-sections up to 6 inch. Up to 20 ft. long.	Orig. received in 5 ton qty x 20' 1) Lengths up to 6 ft. 2) Lengths 6 ft to 20 ft	3"x3"x20ft Angle iron
8 Marshalled/staged piping details	H	Small details easily misplaced on job site, now packed in boxes < 6000 lb.	Controlled and transported in locked metal containers with parts for entire "pallet" release.	Flanges, bolts, valves, elbows
9 Hand rails, ladders large single pipe sections	J	15 ft to 30 ft in length under 4000 lb.	----	2 ft. dia. ASA #20 Seamless pipe
10 Electrical and metal cable	K ₁ K ₂	Stored on large hubs	1) Up to 7500 lb. 2) > than 7500 lb	----
11 Steel plate	L ₁ L ₂	Small nested type plate details and weldments	1) Up to 6 ft x 12 ft & < 7500 lb. 2) > 7500 lb, bulky, or over 6'x12'	----
12 Sheet metal and expanded met. (grate)	M	Min. 4'x6' Max 4'x12' Sheet (flat)	----	Stair tread, etc.
13 Oil/Grease Hazardous waste	N	Stored in 55 gal. drums	Accountability and control of hazardous materials	Lubricating oils, solvents.
14 Paint	P ₁ P ₂	1) Stored in 5 gal. containers 2) Stored in containers > 5 gal	----	----
15 Formed sheet metal	M ₂	Light gage sheet metal formed < 10 ft long	Requires no sand blasting but may or may not be painted	Duct work
16 Miscellaneous pipe	A ₃	All other pipe not meeting requirements of A ₁ , A ₂ , J, etc.	----	Loose pipe sent out for galv.

MATERIAL HANDLING - "LIGHT" LOADS/WEEK (Average)
(Sample Period June 18, 1985 through July 16, 1985)

CURRENT METHODS 6 PROCEDURE'S

"NORMAL TRANSPORT" Vehicles Used To Ship From:	WHSE. #1	WHSE. #2 & #3	PLATE SHOP	FAB'D PARTS YARD STORAGE	PIPE SHOP	MACHINE SHOP	SHEET METAL S H O P	COMBINED	
*ICK-UP TRUCK	28.Tripq of 1.5 skids ea.	4.6,Tripq of 1.6 skids ea.			4 Trips of 1 skid ea.				
*STAKE BODY TRUCK	27 Trips of 4 skids ea.	9.3 Trips of 4 skids es.	36 Trips of 2,350# ea.	36.7 Trips of 4,3 skids ea.	14 Trips of 1.4 baskets ea	6.9 Trips of 2,1 akids ea.	8.8 Trips	1 Trip of 3 skids ea.	4 Trips of 3.8 skids ea.
TRACT/TRAILER	3.3 Trips (heavy loads)		52 Trips of 11,720# ea.	25.3 Trips of 6.7 bask/skid		3.0 Trips (heavy loads)	10 Trips of 12.7 skids ea.	5 Trips of 16 skids ea.	17.5 Trips of 10.8skids ea.
R.R. CAR			1 Trip of 45 tons ea.						
MULE TRAIN									7.0 Trips of 18.8 skids ea
MULTI-PALLET LIFT TRUCK									1 Trips of 3 skids ea.
FORK LIFT TRUCKS		19.6 Trips of 1 skid ea.	58 Trips of 615# ea.		1.8 Trips of 1 akld ea.	.8 Trips of	3 Trips of 1 skid ea.	3 Trips of 1 skid ea.	
ESTIMATED WORK LOAD AS A % OF CAPACITY.			60%		85%	95%	100%	100%	

NOTES: The main fleet of tract/trailers use "Yard Jockey" caba which are not sproved for over the road use due to the hydrsulic 5th wheel.
The "Yard Jockey" fleet is aging. Heavy loads on a "Yard Jockey"/Tractor combination must sometimes be chain pulled by an over the road tractor to get up some-of the levee inclines.

*: In addition to the above numbers for pick-up trucks and atake body trucks, the dispatching function averages 53 weekly yard calls from various areas throughout the shipyard. The majority of these calls are handled by stake body trucks (88%). However, in these csses a stake body truck may be assigned to handle a pick-up truck sized load if It is in the general location of the move call.

3. TRANSPORTATION EQUIPMENT

3.1 Review of Present Material Transport System

The data shown in Exhibit II-15 provided the basis for the transportation analysis covered in this section. The mid-1985 assignments of the transport vehicle fleet for handling light loads is shown in Exhibit III-1.

a. Pickup Trucks

The total number of pickup trucks now being used by warehouses #1 and #2 are averaging approximately 37 trips per week or 7.4 trips per day. That data reduces to 1.8 trips per day per vehicle. Average time per trip should probably not exceed 1 hour. If the number of pickup trucks assigned to warehouse #1 were reduced to two (2), the average number of trips per truck per day would be increased to approximately 3.7. Since two (2) additional small trucks are located nearby (one each at the carpenter shop and mold loft) and two (2) are located nearby in the sheet metal shop, there appears to be no good reason for maintaining such a large number of pickup trucks at warehouse #1. Until just recently there was even one (1) more pickup truck at warehouse #1; that truck has now been assigned to the east bank warehouse principally for personal transport.

According to the latest information received from Plant Engineering, that function alone has a large fleet of pickup trucks as well as stake body trucks.

A study of usage of vehicles by the plant engineering and maintenance function was not a part of this project; however, it is very probable that these vehicles are under utilized.

Although the pickup truck fleet is used for hauling pallet loads of material (in a hurry) on occasion, most of the fleet is idle or empty at any point in time. These trucks appear to be used principally for convenience and/or personal transportation.

The pickup truck fleet for handling" light loads is larger than should be considered necessary in a shipyard of this size.

b. Stake Body Trucks

Stake body trucks now assigned to warehouse #1 are averaging 3.7 trips per day each, including yard calls. That averages out to over 2 hours per trip. This number includes the normally high waiting times for unloading vehicles around the yard. However, as an example of better truck utilization, the plate shop was averaging over five (5) trips per shift with the one (1) stake body truck assigned to that area.

The stake body truck assigned to the pipe shop is very poorly utilized. That truck was averaging less than 3 trips per day, usually to the pickling and/or sandblast and storage areas. Over the length of the study, the shipments from the pipe shop only averaged four (4) baskets/tubs (or skids) per day.

Almost all of the company's other stake body trucks that were observed during the study were under utilized with respect to load bearing capacity and/or space capacity. The plate shop's average weight haul per stake body truck trip was under 2500 lb. (versus the 7500 lb. average of the pipe shop). Most of the other areas using stake body trucks were averaging only four (4) pallet loads per haul. It should be noted, however, that during the course of the study some stake body trucks were seen to be overloaded. With only a few area exceptions such as the plate and pipe shop, more than 94% of all vehicle loading is performed using 6000 to 8000 lb. capacity lift trucks.

c. Mule Train

The mule train concept was introduced some 8 years ago after it was seen working well at NASSCO. At Avondale, because of the grades of the levee, etc., brakes had to be put on the units, which is different and more costly than operating on a "flat" yard such as NASSCO. Even so, it is still very cost effective. Lift trucks of 6000 to 8000 lb. capacity are used to load the blast and paint area mule train. Although the mule train was designed to use its own fork equipped tractor to load and unload the pull carts, this part of the tractor has been out of operation for a very long time.

The mule train is an effective method for transporting skids on the south side of the levee from blast/paint to storage. It has been averaging 19 skids per trip which is about double the load carrying average of the flat bed trailer fleet and over four times the average of the stake body fleet. However, on average, the mule train is used for only 7 trips a week; an effective tool being poorly utilized.

3.2 Review of Present Personnel Transport-Equipment

The prime modes of people transportation within the yard at Avondale are:

- a. Walking
- b. Motorcycle
- c. Bicycle
- d. Small truck

Although Avondale management felt that small trucks were being used heavily for transporting work crews around the yard, this was not found to be the case, at least during the day shift working hours. Since the advent of the process lane methods, work crews do not generally move about the yard as in the past. There is some movement of personnel by light truck just prior to the day shift starting time. This appears to be a matter of convenience only in getting people from parking locations to distant work areas.

It became clear during the course of the study that motorcycle travel is the second most widely used form of

transportation within the yard. The company has approximately 347 motorcycles in use. Available records show that they are all of Japanese make. The motorcycles are generally not capitalized but are expensed to the various using departments. Maintenance charges for motorcycles during 1984 were over \$70,000 or approximately \$200 per vehicle. The new motorcycles cost approximately \$800 each. If we assume the motorcycles are only worth \$300 each on averager the "used" replacement cost/or sales price is \$104,100.

3.3 Transport vehicle Utilization Study

A detailed study of levee traffic was performed to get an indication of vehicle usage.

a. The Study

An observation study was set up and performed along the levee road during a 1-1/2 week period in August, 1985. The observations were taken daily at each of three locations along the road. The observation locations are shown in Exhibit III-2. Each location was changed throughout the day and alternated at different times so that a representative look at the entire road was achieved.

In addition to observing the number of vehicle movements, the loads being carried by each vehicle were also noted. Based solely on observer judgement, the approximate load sizes were noted and tallied. The results of that study are charted in Exhibit III-3.

As can be seen from the charted data, load efficiencies are generally poor. Although it would be impossible to approach 100% load efficiency, it should not be impossible to approach 60% load efficiency with a good dispatch system and back hauls.

b. Pickup Trucks

As was expected from casual observations and borne out by the study, the pickup truck fleet is being under utilized for material handling. A full pallet load of material was only being carried just over 7% of the time.

It had originally been assumed that pickup trucks would probably be used to a great extent for moving **personel**, work crews, etc., about the yard. A review of the truck dispatching log for the entire month of June, 1985 showed only one call for moving personnel. The study of traffic along the levee road showed that less than 2.0 percent of the pickup truck traffic was used for transporting more than three personnel plus the driver at one time. Contrary to the study data available, interviews with yard personnel suggested a heavy usage of pickup trucks for transporting personnel, tool boxes, etc. These statements could not be verified through observations during the period June through mid August, 1985.

c. Stake Body Trucks and Travel Trailers

The stake body truck fleet and the tractor/trailer movements observed indicated a somewhat better overall load efficiency. However, at 35.3% and 40.5%, respectively, this is still relatively low.

d. Motorcycles

A definite statement with regard to the utilization of motorcycles throughout the yard cannot be made, since only the levee road was surveyed. However, observations indicate that the levee road is probably the main route taken by motorcycle traffic. From the data recorded, a very rough analysis on utilization shows that, on average, each of the 347 motorcycles on site makes less than one round trip per day on the levee road. The conclusion is that this indicates relatively poor utilization of the motorcycle fleet based on the high number (347) of vehicles available. A small part of the fleet of motorcycles is very heavily used, the major part is clearly seldom used. The number of motorcycles on site could probably be reduced following a detailed study of individual user needs. It should be pointed out, however, that this mode of transportation is an excellent choice for supervisory personnel who must travel relatively long distances on site. Given the supervisory needs for these types of vehicles, this

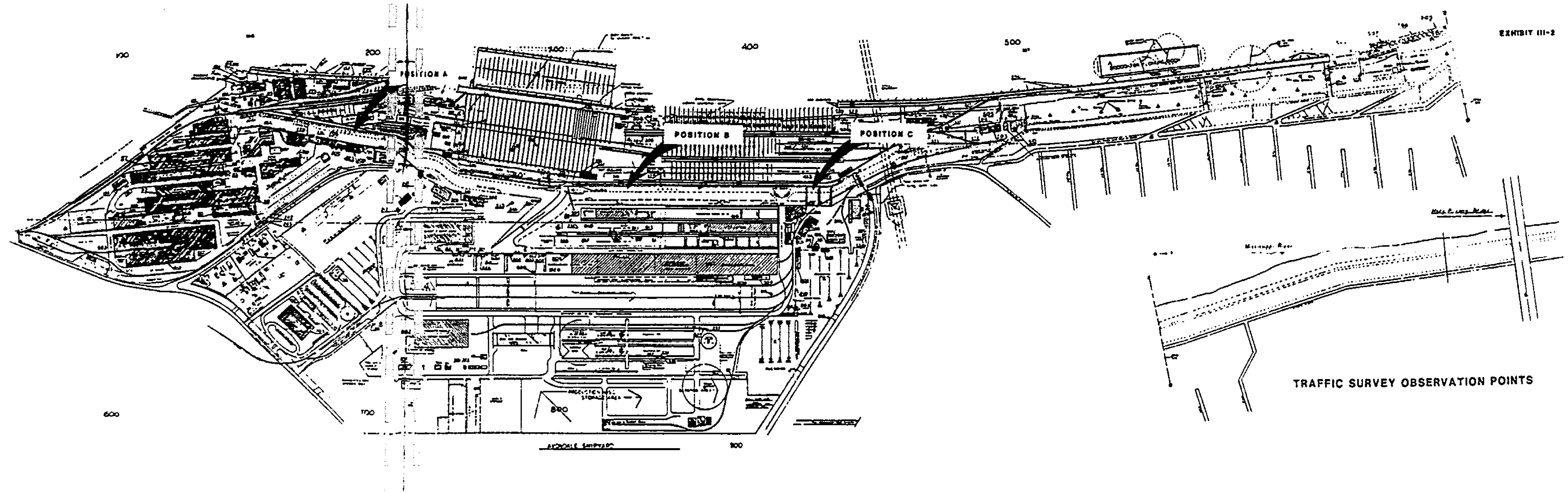
portion of the fleet will probably never achieve a high utilization rate. The remaining portion of the fleet should be studied in detail. Estimates are that 1985 maintenance charges and three year life cycles for motorcycles will cost Avondale over \$180,000 per year.

Alternative systems for both truck transportation and people movements appear to be warranted. These are covered in Sections 4 through 9 of this report.

HID 1985 ASSIGNMENTS
TRANSPORT VEHICLE FLEET
(LIGHT LOADS)

	<u>PICKUP</u> <u>TRUCKS</u>	<u>STAKE BODY</u> <u>TRUCKS</u>	<u>FLAT BED</u> <u>TRAILERS</u>
Construction Services	2	2	
Upper Yard Ship Constr.	1		
Electric Shop-Lower Yard	3		
Warehouse #1	4	4	
Quality Control	2		
Repair Department	2		
Pipe Shop	1		
Electrical Repair Shop	1	2	
Production Department	2		
Paint Department	1		
Outside Machinists-WD#1	1	1	
Gas Free Plant #1	1		
Welding Department	2	1	
Sheet Metal Shop	2		
Mold Loft	1		
East Bank Warehouse	1		
Welding Rod Storage Dept.		1	
Drydocking & Launch Pltfm		2	
Outside Machinists-WD#3		1	
Riggers		2	
Rubber Plant		2	
Carpenter Shop		1	
Fabricated Steel/Pipe		4	38
Storage Area			
TOTAL	27	23	38

*One stake body each assigned to plate shop and pipe shop.



TRANSPORT VEHICLE UTILITY

TYPE OF TRANSPORT VEHICLE	TOTAL NUMBER OF OBSERVATIONS	PROPORTION OF TRIPS BY ESTIMATED LOAD					*LOAD EFFICIENCY
		EMPTY	1/4 LOAD	1/2 LOAD	3/4 LOAD	FULL	
Pick-up Trucks	985	54.8%	26.5%	7.8%	3.7%	7.2%	20.5%
Stake-Body Truck	173	45.1%	12.1%	15.6%	11.0%	16.2%	35.3%
Tractor/Trailer	124	57.3%	1.6%	0.8%	2.4%	37.9%	40.5%

$$\text{*Load Efficiency} = \frac{\text{Total Partial Loads}}{\text{Potential Loads @ 100\% Full}}$$

STUDY BASED ON LEVEE ROAD TRAFFIC - Weeks Starting August 5 and August 12, 1985.

4. METHODS AND EQUIPMENT USED TO MOVE LIGHT LOADS OF MATERIAL
AND PERSONNEL ONTO AND WITHIN SHIPS

4.1 Onboard Ship and/or Construction Unit

Material handling from dockside or staging to onboard ship or construction unit is now handled principally by heavy crane. Minor moves of very light tools, cable, pipe, etc., are generally carried manually if:

an elevator or short stairway is available, and
the loads are under 50 lb.

At the present time, single pallet lifts are the main means of moving materials onboard ship. These are usually handled with the light hooks of the heavy cranes.

If decks are clear onboard ship, which they seldom are, a fork lift truck can be placed directly on the deck or below decks for handling some loads. Material in confined spaces below decks is generally manhandled or moved by chain winches set up by "rigger" classified personnel. If cramped access ways are encountered, it is not uncommon to flame cut out a larger access for material handling purposes. This is particularly true with ships undergoing repairs and/or conversions.

One of the biggest problems affecting material handling by crane is the need for existing cranes to perform essentially two functions:

The handling and holding (for lengthy periods) of
heavy loads or ship sections.

The expeditious movement of light loads.

Most of the Whirley type cranes in use at Avondale have been primarily designed for handling very heavy loads. As such, during the long periods of time when the crane is, say, holding a ship section in place, it is unavailable for handling the brunt of the material movement requirements - light loads.

The following is a typical list of the light loads observed on ship:

Toolboxes	Welding cables and hoses
Portable power supplies	Trash containers
Scaffolds	Loose pipe
Electrical cable on spools	Gas bottles
Spare parts	Temporary beams for winches
Valves	Plywood and timber blocks
Drums (oil, grease, etc.)	Rigging gear
Storage lockers	Jigs and fixtures
Sandblast equipment	Concrete blocks
Paint equipment	Steel details
Duct details	Portable toilets
Ventilation equipment	Ladders
Wood planks	Portable offices

The above list is not meant to be all inclusive, but is a representative sample.

Movement of light loads from deck set-down areas to point-of-use within the various ship configurations is a continuing "man-handling" problem. One of the major contributing factors towards this situation is the normal clutter associated with ship construction. That is, deck areas

are not clear in that welding lines, electric lines, hoses, etc., are usually covering the floors of most work areas. There are few, if any, clear paths for moving materials with the help of floor type pallet jacks or other small vehicles. Most loads that are too heavy to manhandle are moved with the use of chain pulley systems where "rigger" personnel must be called.

A further major problem associated with below deck material handling and personnel movement is floor or deck based scaffolding. With scaffolding fully installed, as is the current practice, there is little room left for maneuvering.

RECOMMENDATIONS:

- a. It is recommended that a planned, individual ship-by-ship, zoned method of scaffold installation and removal be developed and implemented.
- b. If decks and below-deck floor areas can be kept relatively clear, "Rol-A-Crane" type portable winches such as those shown in Exhibit IV-1 could be used for transporting less bulky items up to 4000 lb.
- c. Stringers used for hanging overhead electrical lines should be used extensively for welding lines, hoses, etc., to help keep the lower decks clear.
- d. On upper decks, more use should be made of the upstanding "Y" weldments to keep hoses and welding lines off the decks themselves.

4.2 Crane Activities

In order to determine the extent of crane usage involved in handling light loads onto ships, a sampling study of crane activities was conducted. Sufficient observations were obtained statistically to give an accuracy of + or - 5%.

In conducting the study, the following cranes were observed:

Upper Yard -

- a. Two cranes between the levee and position number 1
- b. Three cranes between the levee and position number 2
- c. One crane between position number 2 and launching position

Lower Yard -

- d. Three cranes at wet dock number 3

Launching Dock

- e. Two cranes

Not all cranes were active every day of the study. Some were idle due to lack of work (the last crane at wet dock #3, for example) and occasionally a crane was idle for repairs. Of the eleven (11) cranes covered by the observations, the average number operating per day was 8-1/3.

The activities of the cranes did not always apply to ships. The cranes listed in b. and c. above were also active at the adjacent platens with 19.4% of their active time and 16.5% of their total time applied to platen operations.

Determining whether a crane load constituted a light or heavy lift was done generally by judgement. In observing the lifts, most situations were obvious. When a load required the

use of the heavy hook of the crane, there was little doubt what category it should be in, but other lifts were not so apparent. In categorizing lifts, the weight of the item was not only considered, but also the shape, bulkiness, and the difficulty of maneuvering it.

The results of the study showed that light lifts at the ships amounted to 74.6% of a crane's total ship activity. When a crane's total operations, including platen activities and idle time, is evaluated, the light lifts take 58% of the crane's total working time. Heavy lifts were 21.8% of ship lifts and only 16.9% of the crane's total. See Exhibit IV-2 for a summary of heavy crane observations.

Thus, when working at a ship, each crane spends about 4.6 hours of an 8 hour day handling light items and 1.4 hours on heavy items. The balance of the time (2 hours) is spent on platen lifts or being idle. It should be noted that the ratio of the number of light lifts to heavy lifts will not necessarily be the same as the time ratio cited. Heavy lifts often involve locating heavy ship sections for joining to previously set sections. This frequently requires the crane(s) to hold the item for relatively long periods of time while it is fastened into place securely enough to release the crane(s). Consequently, the time per lift for a heavy load is usually significantly greater than for a light load.

At present, the same cranes are used for both heavy and light lifts. Except for hoisting and lowering the load, the crane functions -- horizontal travel, jib raising, lowering and

swivelling -- are controlled the same way for a heavy or light lift. Consequently, the design of the crane is a compromise to accommodate two similar but significantly different conditions. As a result, light lift efficiency is sacrificed somewhat, and conflicts in requirements between light and heavy lifts sometimes occur.

Another delaying factor when the same crane is used for heavy and light lifts is in making the changeover in hooks. Different cables are used, and since they are usually not left on the heavy hook, they must be obtained before a heavy lift is made. This often requires horizontal travel which is a slow crane movement.

4.3 Elevator Activities

In shipbuilding, the concentration of people at the start and end of a shift is often exceeded by the on and off activity of people that is going on continuously throughout the workday. Consequently, the method by which people go up or down from 100 to 140 feet can have a significant effect on the overall efficiency of the operations.

Many of the workers who go on and off a ship during the workday may do so more than once, and may perform this routine several times during an 8 hour work period. Climbing a stairway or gangway that is the equivalent height of an 8 to 14 story building is fatiguing and if this is done several times, the tiring effects are significant. Using an elevator instead of climbing stairs reduces the time for the trip, eliminates

fatigue generation, and contributes to more efficient operations. Also, since fatigue tends to increase the possibilities for accidents, the elimination or reduction of activities that cause fatigue will contribute to a safer working environment.

Most workers will use an elevator to go onto the ship at the start of the shift. At the end of the shift, however, instead of waiting for an elevator, most workers use the stairways because it is relatively easy, and hurrying to avoid the crowd is generally the predominant attitude of the workers at quitting time.

Another elevator benefit gained is that workers who would be reluctant to carry even light weight materials upstairs, do so without thinking about it when they are using an elevator.

Since work crews from 300 to 500 are not uncommon requirements on a ship under construction, an elevator capable of transporting such a number of people in a relatively short time is desirable "so that shift changes can be accommodated. An acceptable and convenient size is one with a capacity of 5000 to 7500 lb. or 25 to 35 people. With such an elevator, the round trip cycle can be made in from 1 to 1-1/2 minutes when it is confined to putting a shift crew onboard. Thus, the shift manpower compliment can usually be boarded in from 15 to 20 minutes, with a large crew (500 people) possibly requiring 30 minutes.

Seven (7) to twelve (12) manhours are spent putting a crew onboard at the beginning of a shift. The time for an elevator

lift is less than 30 seconds but including loading and unloading time, the overall time per trip is about 1-1/2 minutes. Consequently, workers can board the ship in about the same time by using the stairway. However, fatigue becomes a factor if the stairway is used. The observations showed that most of the workers are on the ship before the official starting time for the workday so that using the elevator to load a shift has little effect as far as the paid time required is concerned. If, however, crews were considerably larger than those cited, the boarding time could become significant and the use of more than one elevator per ship may be appropriate.

Elevators have been in use at Avondale for many years. The results of studies of three (3) elevators and seven (7) stairways activities show that the elevators are in almost constant use throughout the shift. Stairways, except for those that extend only part way up the ship, are, however, not used a great deal. Although the study period was limited, and cannot be guaranteed statistically, over 400 observations were recorded, and it is felt that the results are representative.

The studies indicate that, not counting the trips to load the crew at the start of the shift, the number of man trips per shift made on three (3) elevators is about 3500, which translates into about 60 manhours per day. If stairways were used instead of elevators, 76 manhours would be required. This is the equivalent of two (2) more people. The number of man trips on seven (7) stairways is about 2100 which takes 45 manhours. Most stairway traffic is on short stairways at

locations that are not served by elevators. In the observations, an up or down lift was considered the same. See Exhibits IV-3 and IV-4 for summaries of elevator, stairway and gangway observations.

It should be recognized that Avondale was only operating at approximately 60% of capacity when the observations were taken. Therefore, at capacity, each elevator would offer approximately a one-person saving per shift and far greater saving in fatigue costs.

**WINCH
OPERATED**

CRANES

Model Number:
WFC-2

Model Number:
WFC-4

ROL-A-CRANE®

Model Number:
WMC-B-RC-M1-RB-OR

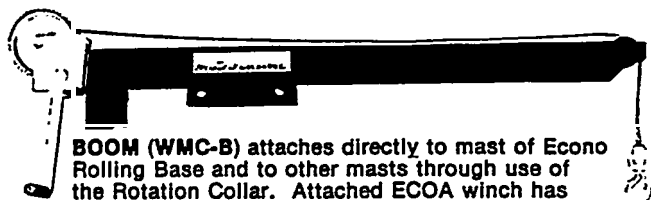
MODU-CRANE

Model Number:
WMC-B-ERB

MODU-CRANE



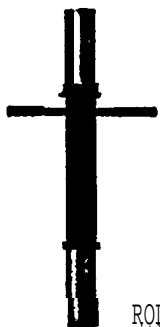
- Telescoping and Fixed Boom models.
- Booms adjust to different work heights.
- Wheels are semi-steel with roller bearings.
- Heavy duty winches have self-energizing brakes.
- Forged swivel hooks and spring loaded safety latches.
- Rugged, welded steel construction for a long service life.



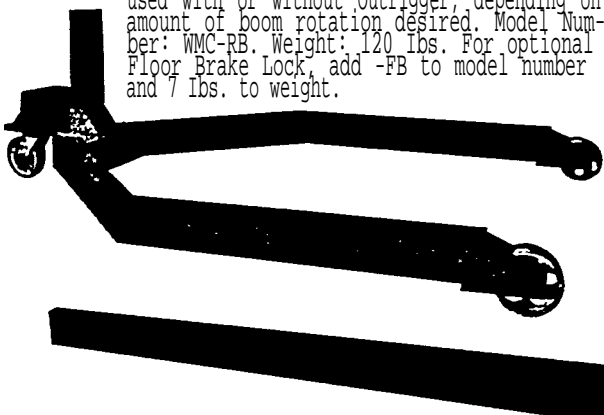
BOOM (WMC-B) attaches directly to mast of Econo Rolling Base and to other masts through use of the Rotation Collar. Attached ECOA winch has a 20 ft. long Hevi-Dutl aircraft type cable and forged swivel hook with spring-loaded safety latch. Model Number: WMC-B. Weight: 55 lbs.



ROTATION COLLAR (WMC-RC) pins to Boom and slips down over the top of Masts. Allows 36°, 104°, or 360° rotation of Boom, depending on Mast used. Knee brace can be positioned to give four different boom working heights. Model Number: WMC-RC. Weight: 22 lbs.



MAST (WMC-M1) is designed for use with Rolling Base WMC-RB. Has handles for steering and boom rotation stops to prevent boom from rotating more than 18° to either side of center unless Outrigger is in place. (This 36° of rotation allows the boom to center itself over the load which reduces the amount of maneuvering required.) Stops can be relocated when Outrigger is used to allow boom to rotate 86° to that side of center. Model Number: WMC-M1. Weight: 39 lbs.

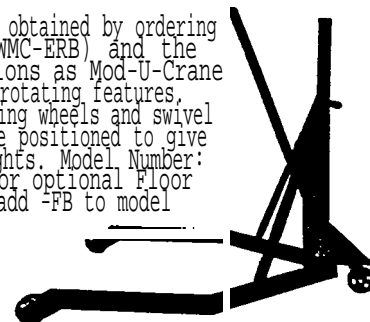


ROLLING BASE (WMC-RB) is designed for use with Mast WMC-M1. Semi-steel 5" dia. roller bearing wheels and swivel rear caster. May be used with or without Outrigger, depending on amount of boom rotation desired. Model Number: WMC-RB. Weight: 120 lbs. For optional Floor Brake Lock, add -FB to model number and 7 lbs. to weight.

OUTRIGGER (WMC-OR) is designed for use with Rolling Base WMC-RB. Allows boom to rotate 88° to one side of center so loads can be lifted and repositioned without moving crane. Locks into either side of base, halfway across for travel, or removes completely. Outer end is supported by a quick-acting floor brake lock. Model Number: WMC-OR. Length: 6 ft. Weight: 45 lbs.

MODURANCE COMPONENTS

A low cost floor crane can be obtained by ordering the **ECONO ROLLING BASE (WMC-ERB)** and the **Boom (WMC-B)**. Same dimensions as Mod-U-Crane with Rolling Base but without rotating features. Semi-steel 5" dia. roller bearing wheels and swivel rear caster. Knee brace can be positioned to give six different boom work heights. Model Number: WMC-ERB. Weight: 116 lbs. For optional Floor Brake Lock at base of mast, add -FB to model number and 7 lbs. to weight.



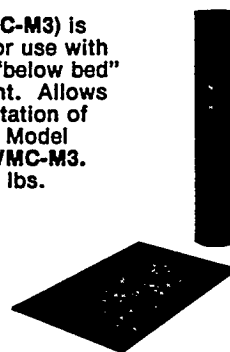
STATIONARY MOUNT (WMC-SM) is designed for use with Mast WMC-M2. Gusseted ¾" x 12" square base plate is for bolting to floors, or decks of mezzanines. Model Number: WMC-SM. Weight: 31 lbs.



MAST (WMC-M2) is designed for use with either the Stationary Mount or "above bed" Truck Mount. Allows full 360° rotation of the boom. Model Number: WMC-M2. Weight: 38 lbs.



MAST (WMC-M3) is designed for use with "flush" or "below bed" Truck Mount. Allows full 360° rotation of the boom. Model Number: WMC-M3. Weight: 49 lbs.



TRUCK MOUNT (WMC-TM) consists of the major materials required to build either a "below bed" or "above bed" truck mount. Base plate is ¾" x 18" x 22". Socket is 19" long and accepts either Mast WMC-M2 or WMC-M3. Construction and installation will vary according to truck frame. Additional bracing, when required, must be furnished by others. Model Number: WMC-TM. Weight: 33 lbs.

NYLON SLING KIT (NYS-4)

Weight: 4½#

RIGGING CAPACITIES: CHOKER 3,000#

ACCESSORIES

Kit consists of four nylon slings, one each, as follows: 1¾" wide by 36", 60", 96", and 144" long.



VERTICAL 3,200#



BASKET 6,400#



ECOA RESERVES THE RIGHT TO CHANGE DESIGNS AND SPECIFICATIONS WITHOUT NOTICE OR OBLIGATION.

MANUFACTURED BY

YOUR DEALER:

1075 HIALEAH DRIVE • HIALEAH, FLORIDA 33010

DOCKBOARDS • DOCKPLATES • YARD RAMPs • WORKSTAGES • PALLET DOLLIES • DOCK RAILINGS FOLDING GATES • JIB BOOMS • CROSSOVER BRIDGES • STOCKPICKER TRUCKS • HYDRAULIC LIFTS SERVICE CARTS • WALKRAMPS FLOOR CRANES • LIFTER/STACKERS

PALLET TRUCKS • ROLLING LADDERS PLATFORM TRUCKS • TWIN RAMPS DRUM HANDLING EQUIPMENT MACHINEDOLLIES • HAND TRUCKS • CASTERS TRAILER JACKS • PALLET PULLERS • DOCK BUMPERS STACKING RACKS • WHEEL RISERS CHOCKS • ELEVATING WORK PLATFORMS

ECOA
EQUIPMENT COMPANY
OF AMERICA

-PRODUCTS PROVEN PROFITABLE FOR PRODUCTION-

From: FLC

HEAVY CRANE SURVEY

TOTAL OBSERVATIONS1476

ADJUSTED OBSERVATIONS (DEDUCT "EMPTY").1261

SHIP ONLY LIFTS:

LIGHT LIFTS77.4%

HEAVY LIFTS22.6%

SHIFT EXAMPLE TAKING INTO ACCOUNT PLATEN OPERATIONS:

LIGHT LIFTS4.5 HOURS

*HEAVY LIFTS1.4 HOURS

PLATEN LIFTS AND/OR IDLE2.0 HOURS

8.0 HOURS

*NOTE: This is only an average. It is not uncommon for heavy holding lifts to take up to six (6) hours.

SUMMARY OF ELEVATOR OBSERVATIONS

A. Occupied observations:	<u>329</u>
B. Empty observations:	<u>125</u>
c. Total observations:	<u>454</u>
D. % of day occupied A/C:	<u>72.4%</u>
E. Total number of people riding:	<u>1169</u>
F. Average number of people per occupied trip E/A:	<u>3.55</u>
G. Number of people waiting:	<u>92</u>
H. Ratio of people waiting to riding G/E:	<u>7.87%</u>
I. Number of elevators observed:	<u>3</u>

Elevator trip time 24 to 29 secondsUse 1 minute

Waiting time for elevator = 1/2 trip time.Use 1/2 minute

Available elevator time per shiftUse 450 minutes

Elevator operators not included in following:

With riders per shift $450 \times 72.4\% = 326$ trips

Total riders per elevator per shift $326 \text{ trips} \times 3.55 = 1157$

Total riders per shift $1157 \times 3 \text{ elevators} = 3471$

Manhours per shift $3471 \div 60 \text{ min/hr} = 57.85$

Man minutes waiting $3471 \times 7.87\% \times 1/2 \text{ minutes} = 137$

Manhours waiting $= 2.28$

Total elevator manhours per shift $57.85 + 2.28 = 60.1$

SUMMARY OF STAIRWAY AND/OR GANGWAY OBSERVATIONS

A. Occupied observations:	<u>284</u>
B. Empty observations:	<u>386</u>
C. Total observations:	<u>670</u>
D. % of day occupied A/C:	<u>42.4%</u>
E. Total number of people occupying:	<u>532</u>
F. Average number of people per occupied observation E/A:	<u>1.87</u>
G. Number of stairways observed:	<u>7</u>

Time to ascend and descend stairs varies depending on height
and person. For average Use 1.3 minutes

Available stairway time per person Use 450 minutes

Minutes stairs occupied per shift $450 \times 42.4\% = 191$

Theoretical trips per shift for one person $\frac{191}{1.3} \text{ minutes} = 147$

Total trips per shift $147 \text{ man trips} \times 1.87 = 275$

Total trips per shift for all stairways $275 \text{ trips} \times 7 = 1925$

Man minutes per shift $1925 \text{ trips} \times 1.3 \text{ minutes} = 2503$

Man hours per shift $= 41.7$

5. PRESENT MATERIAL HANDLING COSTS

5.1 Equipment

1984 maintenance costs were collected using a \$20/hour burdened rate for labor costs and a labor/parts ratio at 60% and 40%, respectively. A 6% increase in costs was estimated for 1985 and a 5-year life was assumed for the purposes of establishing annual depreciation costs. Maintenance costs and depreciation charges were combined to get total annual equipment costs of \$1,546,175. These data are shown in Exhibit V-1.

5.2 Personnel

As of August, 1985, the following number of Avondale personnel* were actively engaged in material handling activities:

<u>LOCATION</u>	<u>NUMBER OF DIRECT MATERIAL HANDLING PERSONNEL</u>
Main Warehouse:	
Dispatch and Drivers	8
Warehousemen	50
Harahan Warehouse	11
Yard Storage Area:	
Dispatch & Drivers	13
Fab, Steel Handlers	13

*Note: Numbers do not include supervisory, clerical, scrap operations, or portable crane department personnel.

Fork Truck Drivers	30
(adjusted for operating time. See <u>Exhibit V-2</u>)	
Expeditors	23
Plate Shop	1.5
Pipe Shop	3
Structural/Plate Yard	8
Blast & Paint	6
Fabrication Shops	2
Building Ways-Crane Operators	5.6
(average for light loads)	
 TOTAL	 174

It should be noted that if there are 57 fork trucks and 30 equivalent full time drivers, then basically 30/57 is the utilization = 53% (or the truck is in use, but not necessarily loaded, 53% of the time). If the actual percentage utilizations reported had been used, 42/57 would indicate 74% of the time the vehicles are in use. But, by observation, the fork trucks are not running this much. Therefore, it is assumed that there are 30 equivalent drivers instead of 42. This includes running both loaded and empty.

Similar to the analysis used in calculating equipment costs, a \$20/hour burdened labor rate has been arbitrarily used for the purposes of calculating personnel costs:

Assuming 250 workdays per year @ 8 hours per day:

174 personnel x 250 days x 8 hr/day @ \$20/hr = \$6,960,000

estimated direct cost of material handling personnel.

5.3 Perishable Items

In addition to standard operating and replacement costs, another large cost associated with material handling is the cost of replacing broken (or missing) wooden pallet skids. Extending data accumulated for the last 7 months of 1984, it is estimated that Avondale will purchase 26,000 Replacement Pallets = \$300,000 Annual Cost. In addition, " it is estimated that 100 pipe baskets will be replaced each year at a cost of \$1,000 each. 100 Replacement Pipe Baskets = \$100,000 Annual cost.

5.4 Fuel Costs

1984 Fuel Consumption:

Gasoline 161,126 gal @ \$.951/g = \$153,273

Diesel 187,972 gal @ \$1.04/g = \$195,464

Propane \$ 38.423

\$387,521

It is assumed that 80% of the gallon totals are used for material handling of light loads. In addition, 1985 estimates indicate an increase in the cost of gasoline of \$.05 per gallon (propane phased out and replaced by *gasoline):

Gasoline 161,126 gal +39,249*gal x0.8x1.00/g = \$153,273

Diesel 187,972 gal x 0.8 x 1.04 = \$156,393

Material handling fuel cost = \$316,693

5.5 Total Estimated Annual Direct cost of Material Handling

Summing the previously developed figures:

Direct material handling labor\$6,960,000
Equipment maintenance and depreciation\$1,546,175
Replacement pallets.....	\$ 300,000
Replacement pipe baskets\$ 100,000
Fuel costs.....	\$ 316,693
Crane delay costs (See Section 9.1)\$ 580,000
1985 Total Annual Costs\$9,802,868

If the study had included supervisory and clerical personnel involved in material handling, and/or some of the mobile crane equipment used around the yard, it is easy to see that total 1585 material handling costs would surpass \$10 million. Escalating costs due to inflation will increase that figure even further in future years. The proportion of charges shown above are charted in Exhibit V-3.

ESTIMATED ANNUAL COSTS OF MATERIAL HANDLING EQUIPMENT
FOR LIGHT LOADS (EXCLUDING CRANES)

NOTE: Does not include Plant Engineering and Maintenance Departmental fleet. Also, does not include equipment assigned to Cafeteria, Security, Personnel, Engineering, or Westwego.

<u>AUGUST '85 EQUIPMENT</u> <u>(NUMBER)</u>	<u>MAINTENANCE</u> <u>1984</u>	<u>EST.</u> <u>REPLACEMENT</u> <u>COST EACH</u>	<u>TOTAL EST. ANNUAL</u> <u>S.L. DEPRECIATION</u> <u>BASED ON 5 YR LIFE</u>
Pickup Trucks (27)		\$10,600	\$57,240
Stake Body Trucks (23)		\$17,250	\$79,350
Flat Bed Trailers (38)		\$1.2,750	\$ 96,900
Fork Lift Trucks:			
Warehouse Type (31)		\$22,000	\$136,400
Rough Terrain Type (24)		\$33,500	\$160,800
Economy Lifts (3)		\$ 6,000	\$ 3,600
Steinbeck Unit (1)		\$120,000	\$24,000
Pickpockets (3)		\$ 65,000	\$ 39,000
Cherry Pickers (1)		\$ 96,000	\$ 19,200
Multi Pallet Lift (1)		\$42,000	\$ 8,400
Yard Jockeys (7)		\$40,600	\$56,840
Yard Tractors (2)		\$62,000	\$ 24,800
Mule Train Tractor (1)		\$25,000	\$ 5,000
Mule Train Trailers (31)		\$ 3,900	\$ 24,180
Side Loaders (3)		\$40,000	\$ 24,000
50 Ton Transporter (1)		\$70,000	\$14,000
 TOTALS	 \$728,741		 \$773,710

6% estimated increase for 1985 = \$772,465

Total estimated cost of material handling equipment excl. cranes \$1,546,175

*1984 total maintenance and parts cost less labor, fringe benefits were accumulated. Labor/parts ratio was estimated at 60% and 40%, respectively. A \$20 per hour burdened labor rate was assumed.

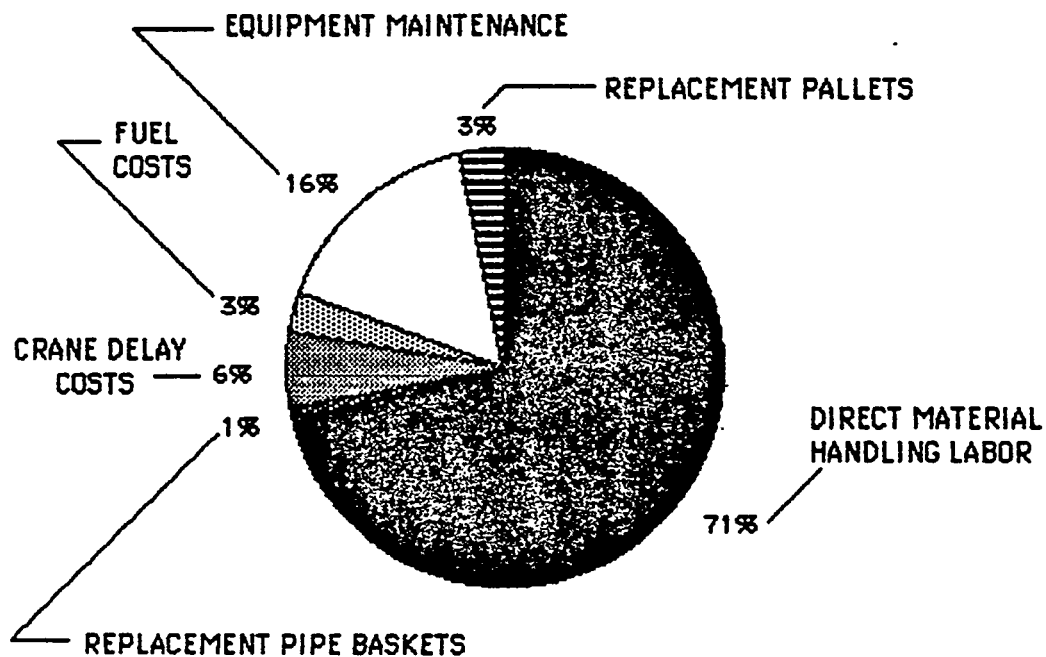
UTILIZATION OF FORK LIFT TRUCK FLEET

<u>LIFT TRUCK</u> <u>NUMBER</u>	<u>LOCATION</u>	<u>*TYPE</u>	<u>NUMBER OF DRIVERS</u> <u>1D/ 2N</u>	<u>1st SHIFT % UTILIZATION</u>	<u>USED ON 2nd SHIFT</u>
3134	Plate Shop	W/H	1	90%	YES
4136	Rubber Plant	W/H	3	60%	—
4155	Machine Shop	W/H	3	90%	YES
4165	Pipe Shop	W/H	2	70%	YES
4166	Paint	W/H	2	60%	YES
4316	Carpenter	W/H	1	50%	—
4401	Pipe Module	W/H	1	60%	—
4409	Receiving	W/H	2	90%	—
4410	Warehouse	W/H	1	85%	—
4411	Westwago	W/H	3	50%	—
4529	Bldg Ways	R/T	1	75%	—
4530	Sheet Metal	W/H	3	90%	YES
4531	Paint	W/H	3	80%	YES
4532	Electric	W/H	3	50%	YES
4534	Scrap	R/T	2	60%	—
4704	Warehouae	W/H	3	80%	—
4782	Maint	R/T	3	75%	—
4533	Maint Whse	W/H	3	70%	—
4783	Bldg Ways	R/T	1	90%	YES
4784	Paint	R/T	1	80%	YES
4793	Yard Storage	R/T	1	90%	—
4794	Warehouse	W/H	1	70%	—
4821	Warehouae #2	W/H	2	70%	—
4822	Warehouae #3	W/H	2	70%	—
4824	Riggers	W/H	3	70%	—
4835	Warehouse	W/H	1	80%	—
4836	Cent Service	W/H	2	70%	—
4972	Dry Dock	R/T	3	75%	YES
4973	Yard Storage	R/T	1	80%	—
4984	Kalmar		1	80%	YES
5157	Riggers	R/T	2	80%	—
5358	WD #1	R/T	3	75%	—
5159	Paint	R/T	2	90%	—
5160	Maint	R/T	1	90%	—
5161	Plat #20 Pipe	R/T	1	90%	YES
5162	Wet Dock #3	R/T	2	70%	—
5163	Yard Storage.	R/T	2	80%	—
5164	Yard Storage	R/T	2	90%	—
5234	Carpenter	W/H	3	80%	—
5524	R&D Storage	ELECT	1	50%	—
5525	Paint	ELECT	1	50%	—
5713	Warehouae	W/H	1	90%	—
5714	shop	W/H	3	70%	YES
5715	Sheet Metal	W/H	3	80%	—
5716	Shotblast #20	W/H	3	80%	YES
5779	Cent Service	R/T	1	80%	—
5780	Cent Service	R/T	1	60%	—
5785	Welding	R/T	2	60%	—
5786	Platen 23	W/H	3	60%	—
5799	Yard Storage	R/T	2	90%	—
5800	Platen 20	R/T	1	95%	YES
5807	Wet Dock #1	W/H	3	60%	—
5808	Yard Storage	SIDELOADER		50%	—
5806	Maint Whse	W/H	3	80%	—
5809	Warehouse	SIDELOADER		50%	—
5810	Warehouse	SIDELOADER		50%	—
5878	Multi Loader		3	80%	—

At percentages stated above: 41.9 Personnel are employed full time on fork lift trucks. For purposes of future calculation, use a conservative figure of 30 Personnel.

*W/H = Warehouae, R/T = Rough Terrsin
3 drivers indicates many operators have access

TOTAL ESTIMATED ANNUAL DIRECT COST OF MATERIAL HANDLING



6. STORAGE

6.1 Warehouse #1

All paperwork receipts of material are centralized in warehouse #1. This warehouse also physically receives "a large portion of all incoming goods. Large, heavily used or specialty items, such as raw pipe, galvanized pipe, paint deliveries, etc., are taken directly to their own particular storage points about the yard. However, the official receiving paperwork is handled by the receiving function in warehouse #1.

The warehouse is equipped with an overhead 100 ton crane located in the middle bay at the west portion of the warehouse over incoming railroad track. The remaining portion of the middle bay is equipped with a 25 and 5 ton overhead crane. This middle section of the warehouse is normally used for storing large, bulky items that cannot be handled with a standard fork lift truck.

Pallet racking configured for narrow (5.5 ft.) aisle equipment is used in most of the other areas within the warehouse.

Two warehousing personnel start work at 4:00 a.m. each morning. They stage material for dispatching at 7:00 a.m. and place incoming material (from the previous day) in multi-tier pallet racks.

"Pickpocket", narrow aisle fork trucks, are used for most skid-sized storage on 4 ft. x 4 ft. wood pallets. See Exhibit II-11. These "Pickpocket" units were designed by Avondale in

1973-74 after an exhaustive study of equipment available at that time showed that nothing else was available to do the job of lifting and placing 3000 lb. loads on 4 ft. x 4 ft. pallets up to 26 ft. high using a very narrow aisle, with a man riding up with the load. The market has changed and many more commercial units of this kind are now available. The "Pickpockets" have some limitations as follows:

- a. They have 3000 lb. maximum capacity.
- b. They cannot handle lengthy pallets (e.g. 4 ft.x 8 ft. long pallets will not fit, although pallet cross beams can take 8 ft. long pallets). Maximum cross beam loading = 8300 lb./pair of (2) 4 ft. x 4 ft. pallets.
- c. The "Pickpockets" cannot be used as floor placement vehicles as the forks will not allow the load to. be set down on the floor. Another standard fork truck must be used after the "Pickpocket" places the load on an intermediate "table." This results in a two-man, double-handling operation to move material to the dispatching area.
- d. Since the "Pickpockets" do not have 4 - directional turnaround capability, wide turnaround aisles are required.

Pallet racking varies from 4 high to 6 high, depending on roof slope. The great majority of rack stored items are less than 4 ft. x 4 ft. x 44 inches high.

Some cantilever racking is used for long loads. In this

case a sideloader (capacity = 6000 lb.) is used for loading and unloading.

Two (2) Economy lifts are used for picking materials where the operator goes "up" with the unit - 400 lb. maximum load.

The one (1) Steinbeck Depot lift with 3300 lb. maximum load capacity has better maneuverability than the "Pickpocket" in the narrow aisles. However, the operator does not go up with the unit and has difficulty judging the higher lifts.

It is recommended that the "Pickpocket" trucks be phased out in the long term and be replaced by newer turret-type high lift trucks now available on the market. The "Pickpockets", which are getting old, seem to suffer many breakdowns and are subject to a lot of maintenance. However, it is difficult to justify their replacement economically in the short term, especially since temporary replacements can be obtained on a rental basis.

6.2 Warehouse #2

Staging/Marshalling: Pipe fitting details and materials are received in warehouse #2 from warehouses #1 and #3. These details (determined by material control) are staged for a particular "pallet" drawing. All of the bits and pieces for a particular drawing are placed in locked sheet-metal containers, stainless steel ID tags are prepared and attached, and the container contents are approved by both warehousing and pipe shop personnel. The locked boxes are then delivered to the particular work area per the production schedule (usually platen #20/23, the new module shop, or wet dock #3). All

materials are handled on wood skids using fork trucks and "Pickpockets". NOTE: The pipe department handles returns of empty containers.

Warehouse #2 basically contains Avondale stock material (overflow from warehouse #3), government furnished materials and contractor furnished materials. The environmental controlled area contains IBM paper storage, provisions for sea trials and some valuable storage items that could easily be pilfered (ship TV's, etc.).

Pallet rack cross beams will support 5000 lb. maximum load per pair (2 skids). Aisle widths of 5 ft.-6 inches are used for "Pickpocket" operations.

The facility has no overhead cranes.

Locked box material is generally accumulated during the week and shipped on Friday. Boxes are placed on stake body trucks or trailer with a one (1) week lag, i.e., shipments on June 14 are for the work schedule starting Monday, June 24. It was also noticed during the study that some of the metal lock boxes had flat bottoms and had to be placed on a wooden skid for handling. It is recommended that new boxes have fork lift runner channels installed on the bottom of the boxes so that wooden skids are not required.

6.3 Warehouse #3

This facility, for the most part, warehouses very light loads. It has a low ceiling and most areas are set up with bins for hardware type items. Some large valves are stored in

warehouse #3 in low racks or on the floor. Many items are hand-picked onto pallets. All loads can be transported by fork truck, hand pallet trucks, or manually.

The warehouse is basically split into three sections:

- a. Hardware
- b. Pipe Fittings
- c. Stock Material

Personnel hand deliver material (or use a lift truck) if it only has to go a short distance to the pipe shop or the sheet metal shop. All other materials are picked up by dispatching personnel from warehouse #1 and sent directly to work centers. Usually two or three pickups per day with a pickup truck or stake body truck account for all of the moves from warehouse #3.

6.4 Yard Storage

The space allocated for yard storage covers a larger area of the yard than depicted officially on yard drawings. As an example, almost the entire side of the roadway next to the steel plate and structural storage area is dedicated to skid storage of fabricated materials.

The area dedicated for cable storage is outfitted with pallet rack five tiers high along with space dedicated for ground storage of large reels. There is also pallet rack storage for blowers and other ventilation equipment. Aisle spaces run up to 23 feet wide in some areas. These spaces could be reduced significantly if a side loader or turret truck

was used all of the time in this area. (A side loader is available in the yard storage area and is used frequently.)

In the fabricated parts storage area (and in the warehouses) the predominant "container" used for holding parts is the 4 ft. by 4 ft. wooden skid. Also used to a lesser extent are 4 ft. by 8 ft. wooden skids. Purchase orders for 15,000 wooden skids to cover the 7 month period, from June 1, 1984 through December 31, 1984, were issued in the amount of \$163,000. Prices have since increased considerably. It is estimated that approximately \$300,000 will be spent in 1985.

It is recommended that alternative skid concepts be tested in the yard. See Exhibits VI-1a (Aluminum) and VI-1b (Steel) for details. The cost ratio (using Avondale labor rates) has been estimated for the aluminum version/wood = 8.8/1; the steel version/wood = 6.8/1.

It is difficult to estimate the potential savings from converting to metal skids since the turnover rate of wood type is not known. It is recommended that a half dozen or so of each type be paired up with new wooden skids in the yard in an effort to track lifetimes of each. When turnover rates of each type are determined, a final decision on material types can be made. Samples of the steel pallets (Styles A,B and C) are now being made so that tests can be run.

The concept of using heavy-duty plastic skids should also be tested. One such type manufactured by Sheller-Globe Engineered Polymers Company in Mora, Minnesota, sells in volume quantities for \$37.00 to \$44.25 each. Others are available.

Another area where equipment changes would benefit Avondale is in the fabricated pipe storage portion of the yard. This storage area could be reduced significantly if decking and a Gradall "Loed" or Pettibone "Extendo" material handler were used. These machines are extremely versatile and cost from \$55,000 to \$78,000 each. See Exhibits VI-2 and VI-3. These machines can also function as small cranes if the need arises. See Exhibit VI-4 for changes that could be made to yard storage to reduce space requirements. There would be some investment required in pallet rack and/or decking to raise the middle tier; however, the potential space savings would be well worth the investment. It is estimated that the existing 18 rows of pipe baskets/skids can be replaced by 15 rows of 4 deep skids as shown in Exhibit VI-4. This will yield an increase of 67% in the number of baskets/skids stored. Conversely, the pipe storage area length could be reduced by over 200 feet.

6.5 Harahan East Bank Warehouse

In the June-July period of 1985, approximately 40,000 square feet of the 100,000 square feet building was being used for spare parts storage. The remainder was to be used for surplus parts storage. The building is not very well suited for warehousing due to a) low ceiling heights allowing only 3 high pallet stacking plus perhaps another half pallet on the upper tier, and b) column spacings of 25 feet which require very wide 15 foot aisles.

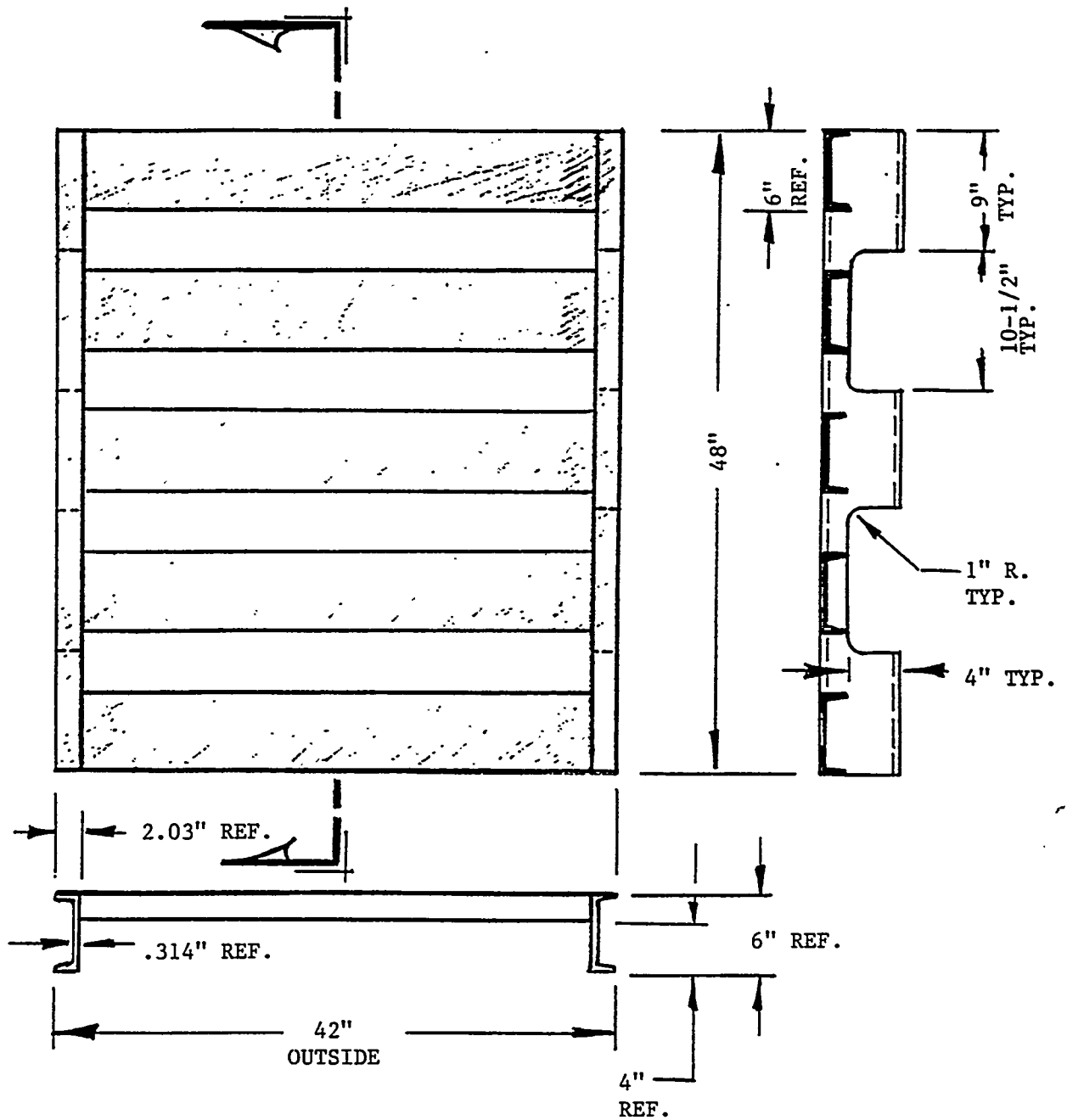
All movements are handled by 6000 lb. capacity fork lift trucks loading-either flat bed trailers or stake body trucks.

The majority of loads are tri-wall containers on 4 ft. by 4 ft. wooden skids weighing under 1500 lb.

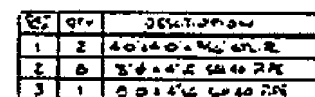
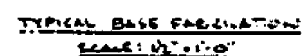
It is recognized that the Harahan warehouse was obtained on short-term lease to meet specific needs, and is tied to contract requirements -- the need for reasonable square feet for reasonable cost, and do the best you can within these parameters. If this warehouse were to be kept long term, it is probable that some changes should be made to improve operating efficiency.

A very preliminary review of this facility suggests that storage space could be increased by 33% with the purchase of one or two double reach fork lift trucks (see Exhibit VI-5) and the installation of an additional line of pallet racking. on every double row to give triple rows. This would reduce aisle spacing to approximately 11 feet which is enough for most double reach fork lift trucks. However, this is based on a preliminary review only; a detailed storage analysis was not performed during the study. Triple rows of racking and the use of double reach fork trucks are only feasible where items on the outer rows do not normally have to be removed and replaced to get at the inner row. As a result of interviews with Avondale personnel, it was assumed this is not the case at Harahan. This should be verified through analysis.

Also, the 12 feet aisle against the long wall on the long building side opposite the offices could be shifted so that a line of pallet racking could sit flush against the wall giving both additional storage space and an additional "picking" face.

ALTERNATIVE METAL SKID

AMERICAN STANDARD ALUMINUM 6061-T6 CHANNEL WELDED CONSTRUCTION
ALTERNATE: STEEL CHANNEL C6X8.2



STYLE A		
QTY	QTY	DESCRIPTION
1	2	3'x5'9" x 1/2" IN 2
2	2	3'x5'9" x 1/2" IN 2

STYLE 13		
SIZE	QTY	PRICE
1	4	12' x 10' x 24 FL R
2	4	12' x 10' x 24 FL R
3	4	12' x 10' x 24 FL R

STYLE:		
PS	WT	COLLECTION
1	2	C5-115-4.0 COTTON

* MAKE: USE PAUET

NOTE:
1 - ALL WEIR) CONSTRUCTION AS SHOWN

<p>AVONDALE SHIPYARDS INC</p> <p>NEW ORLEANS, LA P O BOX 35000 70131</p> <p>DATE OF ORDER 9-11-82</p> <p>PROJECT NUMBER <i>1000</i></p> <p>ENGINEERING SUPERVISOR <i>W. J. [Signature]</i></p> <p>DATE <i>9-11-82</i></p>	<p>6 211 JCB NO</p> <p>PLANT ENGINEERING & MAINTENANCE DEPT</p>
<p>STEEL PALLETS</p> <p>(ALTERNATIVE)</p>	<p>NO. 1000</p> <p>DATE 9-11-82</p> <p>H 031-M85-55M</p>

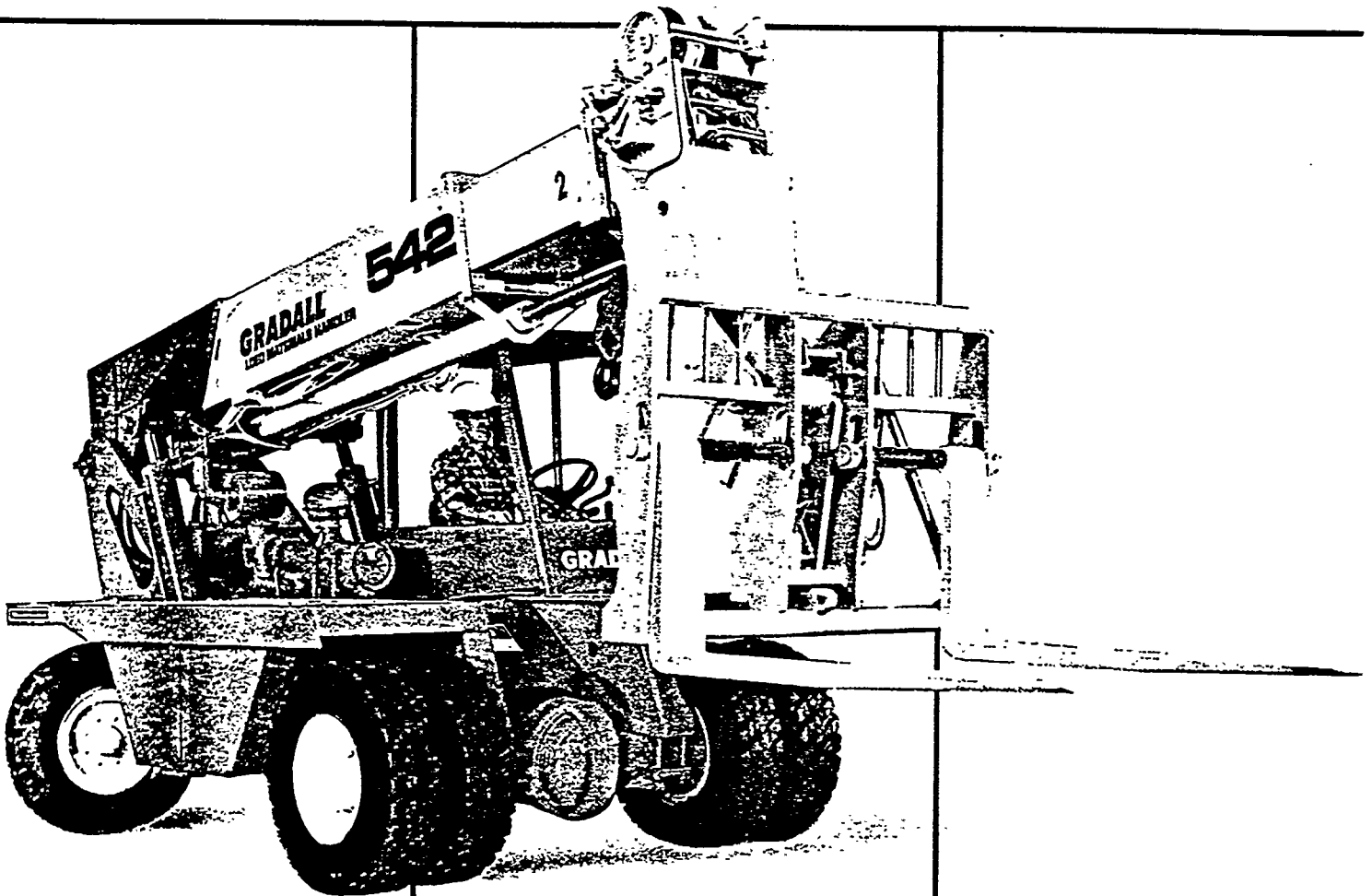
100

542

TWO WHEEL DRIVE
REAR WHEEL STEER
15,000 LB. MAX. CAP.
18' & 26' LIFT HEIGHT

GRADALL^R

LOED MULTI-PURPOSE MATERIALS HANDLER



PETTIBONE EXTENDO

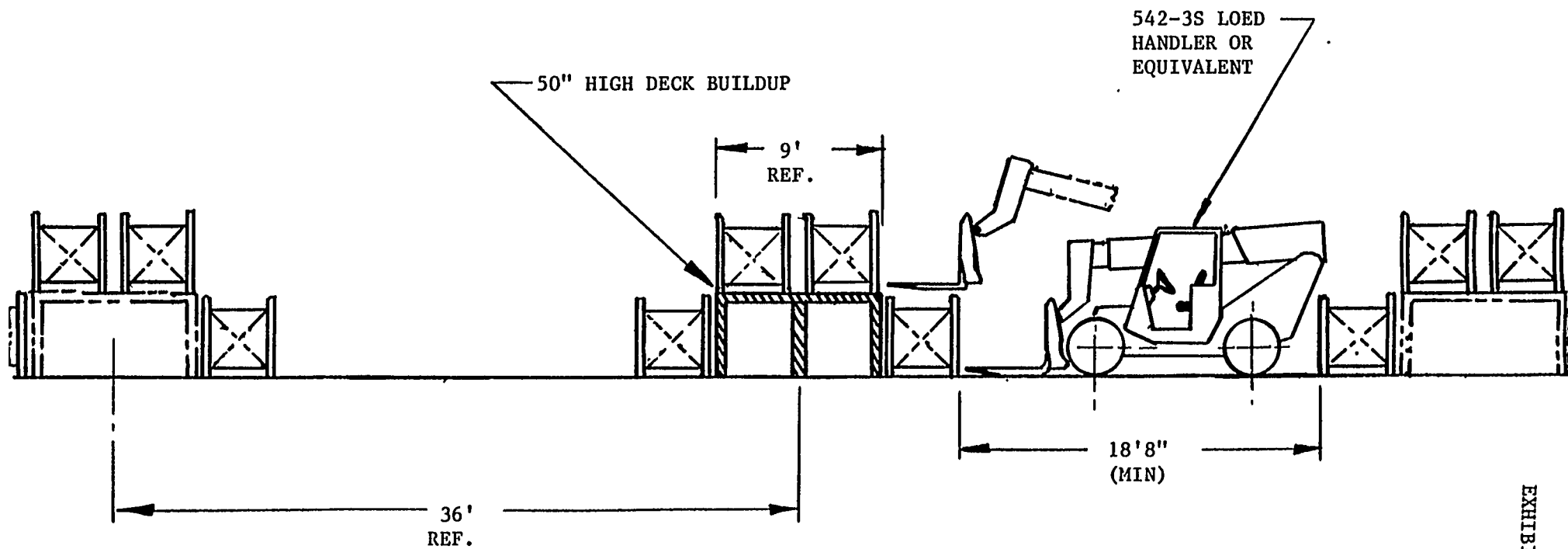
EXTENDO

B-66-B
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B-68-B
B-68-42
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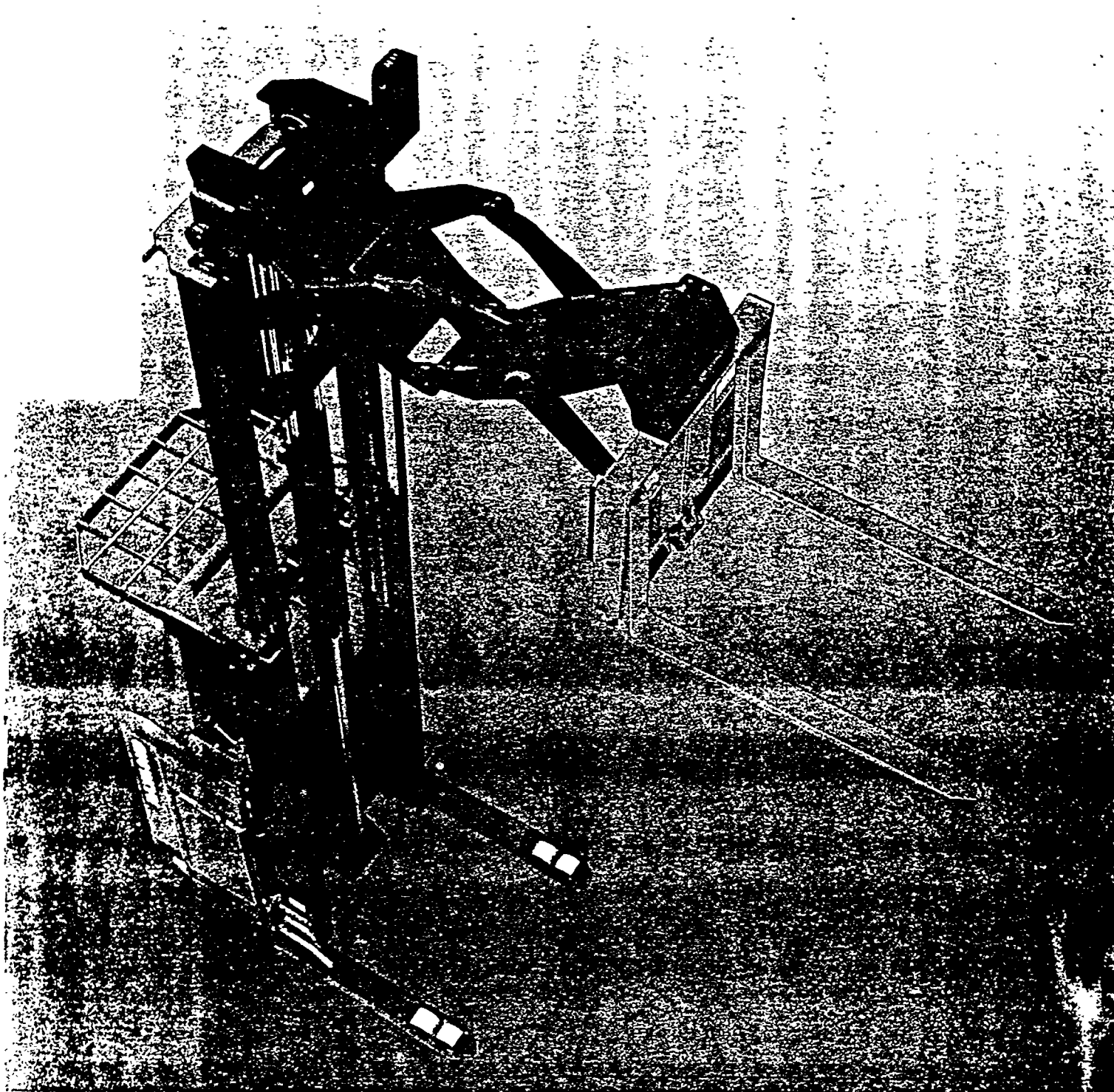


PETTIBONE

CHANGES TO THE FABRICATED PIPE
STORAGE AREA WILL INCREASE CAPACITY BY 67%
OR REDUCE LENGTH OF PIPE YARD BY
200 FT.



DOUBLE REACH FORK TRUCKS



7. MATERIAL FLOW ANALYSIS

7.1 General Material Flow

General material flows and processes were observed throughout the yard. A generalized operation process chart was developed which depicts the typical material flow pattern within the Avondale main yard. This chart is shown in Exhibit VII-1.

Many minor variations not critical to the overall theme are not shown for clarity. The development of the chart took much discussion with such departments as production planning, material control, et al.

7.2 Activity Areas

In order to analyze material flows within the yard, it was necessary to set up some basic, general activity areas to track material movements. The zoned building list, as shown in Exhibit VII-2, details the building list for the main yard. This may be compared to Exhibit I-1 which shows the overall main yard layout. For analyzing basic material flows, this list was simplified into 46 areas as detailed in Exhibit VII-3.

7.3 Data Gathering

Two full time observers were placed in the busiest sections of the yard for data recording purposes. These areas were: a) the main warehouse complex and b) the fabricated parts outside storage area in the back of the yard toward Hwy 18. Accurate data were recorded on all movements out of these two major areas for just over three weeks. The movements were

recorded by the original material class designations described earlier in Section 2 of this report. Some of the other information recorded included the starting and ending locations for transport, type of transport vehicle, number and size of skids, etc. See Exhibit VII-4 for examples of survey sheets.

The other major areas were given survey sheets and recorded their data internally. The areas surveyed in total were:

Fabricated Parts - Outside Storage

Fabricated Pipes - Outside Storage

Drum Storage/Electric Cable Storage

Pipe Shop

Sheet Metal Shop

Machine Shop

Wet Dock #1 - Shops

Warehouses #1, #2, and #3

Platen #1, #2, and #3

Fabrication Shop #2 and Blacksmith Shop

Plate Shop

Roto-Blast Shop

Blast/Paint Area "K"

7.4 Spread Sheet Compilation

Due to the complexities of material classification coding, particularly from the storage areas and others, a computerized spreadsheet was developed. This was used only after a considerable amount of time was expended on manually compiling the data to get them into the proper format for computer

input. This point should be emphasized for the benefit of those readers who believe the computer alone is enough to perform the analysis. An extensive amount of manual effort was required prior to data entry.

The spreadsheet format selected was the Lotus 1-2-3 program from Lotus Development Corporation. The computer used for the compilation was an IBM-AT micro-computer.

An example of the formatted data ranked by number of skids moving from a particular area is shown in Exhibit VII-5.

Graphic plots of the major material flows by material class are shown in Exhibits VII-6 through VII-11.

7.5 Flow Analysis - Major Areas

7.5.1 Yard Storage Movements

The spreadsheet data shown in Exhibit VII-5 indicates that 43 skids per day on average are moving out of yard storage. Of these 43 skids, 11 per day go to Staging Area 307, 10 skids/day go to Platen 20, 9 skids/day go to Platens, 8, 9, and 10.

As shown by the spreadsheet data, these three flows account for 70% of all materials moving from yard storage. Also, approximately 17% of these skids are in the 4 ft. by 8 ft. category. If it is assumed that one (1) 4 ft. by 8 ft. skid is equivalent, space wise, to two (2) 4 ft. square skids, the above skid movements would be increased by a small percentage for calculating truck bed space, etc. However, for the purposes of establishing standard load/unload times all skids are assumed to be equivalent.

At this point in the analysis essentially three (3) different material handling philosophies were considered:

- a. Have the transport vehicle pull a flat bed type trailer and leave the whole trailer at the drop off point. The driver would then return via other pick-up points with an initially empty trailer.
- b. Have the transport vehicle, with the driver, go to the drop off point and wait for an available fork lift truck and a different driver to unload the trailer.
- c. Have the transport vehicle specially equipped for unloading its own trailer. The driver would reach the drop off point and unload the trailer him/herself. The driver would then return via other pick-up points with an initially empty trailer.

It is assumed that the only difference between methods a. and b. above is the difference between driver waiting time and trailer unhitching time. As shown elsewhere in this report, waiting times are now averaging three (3) to four (4) hours per day (this does not include load/unload time). If an average of only 1.5 hours per day penalty for each driver waiting with centralized control were assumed, approximately 1.5×250 days/year or a total of 375 hours per year would be spent waiting. At the rate of \$20/hour used throughout this report, that 375 hours equates to a \$7,500 annual cost per driver.

It should be noted at this point that although one driver from the yard storage area could conceivably handle the

deliveries of materials to Area 307, Platen 20 and a drop off zone for Platens 8, 9, and 10, three (3) separate drop off trailers would be required if method a. is selected. That is to say, a minimum of one drop off trailer would be required for each location.

Based on the estimated costs of the material handling equipment shown in Exhibit V-1, three (3) trailers would cost Avondale over \$12,000 per year in maintenance and depreciation charges. These costs would not vary to any great degree even if smaller than 40 foot long trailers were used. Comparing the \$12,000 equipment cost to the \$7,500 driver waiting costs, it is clearly more favorable to unload trucks quickly at the point of drop off rather than use flat bed type trailers as storage devices.

Having ruled out method a., the differences between methods b. and c. need to be addressed. The cost of per driver waiting time has already been estimated at \$7,500 per year using centralized control. It is assumed that whether he/she unloads their own truck or someone else does, the unload time will not vary. However, if the transport vehicle were equipped to unload itself, not only would the \$7,500 per year waiting time be saved, but conceivably the existing fork lift truck fleet could be reduced along with its associated high maintenance and depreciation costs. Unfortunately, deeper analysis does not bear this out. It can be shown through standard time data that the unloading of a transport vehicle

with a fork truck will take from .015 to .030 hours per skid for travel distances of 50 to 100 feet.

In the case of yard storage to Area 307; Platen 20, and Platens 8, 9, and 10, the data show movement of 30 skids per shift. If the worst condition is assumed of .030 hours per skid multiplied by 30 skids, that is 0.9 hours per shift - standard fork truck time. (This must be factored by allowances to get at actual truck/driver times.) In addition, if pipe storage and yard storage could be handled by the same transport vehicle and driver, an additional 14 long pallets or pipe baskets which move to Area 307 and Platen 20 could be considered. See Exhibit 11-15. This brings the total to 44 skids per day or 1.32 standard hours for fork truck unloading per shift. If deliveries of skids and pipe baskets to Platens 14, 15, and 16 are also included, another 6.4 pallets can be added on average per shift. This brings the standard time total to 1.51 hours. With the addition of a typical 15% allowance to this figure, actual fork truck time of 1.74 hours per shift is obtained. An equivalent time for loading must also be added. Therefore, 3.48 hours would be the average time per shift spent by fork lift trucks loading and unloading transport trucks from yard and pipe storage in the areas mentioned.

The five (5) fork lift vehicles involved in the areas in question are averaging anywhere from 75% to 95% utilization, according to Avondale sources, see Exhibit V-2. Theoretically,

this number could be reduced to four (4) based on the 3.48 hour reduction noted above, plus the difference between say 95% utilization and the current average utilization figures. However, in reality, this will not work since that 3.48 hours is spread across five (5) different fork trucks at five different locations. That time cannot be applied to a single area or location reduction in capital equipment. However, it could be deducted as a labor savings.

Therefore, the total labor time saved per shift would be:

1.5 hours driver wait time/shift

+3.48 hours load/unload time/shift

4.98 total hours/shift x 250 day shifts = 1,245 hours/year

Equating this to dollars =

1245 X \$20 = \$24,900 Potential Savings.

It is estimated that one (1) 40 ft. flat bed trailer and one (1) fork equipped handler with a fifth wheel attachment could easily handle all shift shipments from yard and pipe storage to the areas noted:

	DAILY AVERAGE	DAILY AVERAGE	
	<u>SKIDS</u>	<u>PIPE BASKETS</u>	
Area 307	11	5.5	
Platen 20	10.5	8.5	
Platen 8,9,10	9		
Platen 14,15,16	<u>3.7</u>	<u>2.7</u>	
	34.2	PLUS 16.7	= 50.9

With proper scheduling and stacking, this could be handled

with a maximum of four (4) round trips per shift. At maximum capacity, two of these handler/trailer combinations would be required.

Approximately 17 other locations are served from yard storage. These areas only account for 13 skids and/or pipe baskets per day at the current production level. Even at-yard capacity, these areas could not justify specialized equipment. It is recommended that either standard pickup trucks or stake body trucks continue to be used to service these areas.

Approximately five (5) very long skids per shift of the above listed 51 skids are "J" class material (see Exhibit 11-14 for material classifications). The yard storage area could be reduced somewhat if a side-loader area was set aside for this type of material. The widths presently allotted for aisles are much wider than needed if a side loader was used exclusively.

Approximately 10 of the above listed skids are "M2" class materials which tend to be light, formed sheet metal, however, a portion of these" are held on 4 ft. by 8 ft. skids. This would be in addition to the 17 or so long pipe skids and/or pipe baskets also moving to the four main designated areas. The spread sheet analysis indicates 22 skids and/or baskets per shift would be of the long variety. This shows that 5 to 6 would be on each trailer load along with 7 or 8 standard 4 ft. x 4 ft. skids. With proper stacking this should be easily attainable with one 40 ft. long trailer.

The Gradall materials handler shown in Exhibit VI-2 can be equipped with a quick connect fifth wheel attachment, auxiliary hydraulic circuit and tilting fork carriage for approximately \$76,000. From Exhibit 11-15 it can be shown that 27% of total trailer movements are from yard storage and the fabrication shops and platens. At the time of the study, 9 yard cabs or jockeys were in operation. It is estimated that at least two of these vehicles or 22% could be replaced with one handler similar to a Gradall-type vehicle with a fifth wheel attachment.

Calculating potential cost savings:

	<u>ANNUAL</u>
Decrease in fork lift labor	\$24,900
Decrease in maintenance on two jockeys.. . . .	\$12,000
(fully burdened labor and materials)	
Decrease in depreciation charges on two jockeys...	\$16,240
Increase in maintenance on Gradall or equzv	(\$ 8,000)
Increase on depreciation charges on Gradall or equivalent	(<u>\$15,200</u>)
ANNUAL NET SAVINGS	\$29,940

The cost of small strap-type locators has not been included. These would be required on the back of the trailers to hold the fork lift attachment for transport while the fifth wheel attachment is in use. See Exhibit VII-12.

7.5.2 Warehouse Moves

Similar to yard movements, the spread sheet analysis also includes moves from warehouse #1, #2, and #3 at the main yard.

Like yard storage, 44 skids of material per shift are moving, on average, from the combined warehouses (as opposed to 43 per shift from yard storage). Almost 26% of this movement or over 11 skids per shift go to Platen Area 307. Only 4% of the total are 4 ft. x 8 ft. skids and have little bearing on the analysis other than the preferability of not using pickup trucks for transportation of long skids.

Of the 44 skids:

11.4 skids/shift go to Area 307

5.5 skids/shift go to Wet Dock #3

3.7 skids/shift go to Pipe Shop

3.3 skids/shift are inter-warehouse moves

2.7 skids/shift go to the east bank warehouse

2.0 skids/shift go to Pipe Storage

As indicated in the spreadsheet analysis, these moves account for 65% of total materials moving from the combined warehouses. Moves of less than one pallet a day go to 23 other locations around the site (not including maintenance, engineering and other office locations). Over 49% of this material is "C" and "D" class materials. That is to say, these are small size items that are well under a full skid size in dimensions.

Also it is interesting to note that of the 28 various locations that receive materials from the warehouse (not counting inter-warehouse moves), 17 of these locations or 61% are on the warehouse side of the levee.

Small, light-load deliveries, with many stops suggest the use of a mule train type transport vehicle in order to reduce material handling labor, stacking and unstacking labor, and the excessive back and forth movements that would be required with standard truck-type transporters. Obviously, movements which require exiting controlled areas such as trips to the east bank warehouse and the corporate building will still require either a stake body, truck tractor/trailer or a pickup truck.

Although there are 27 ultimate locations for delivery (excluding outside moves), few individual areas receive daily shipments from the warehouse. As detailed above, only four (4) internal areas could receive daily shipments from the warehouses. Short moves, such as between warehouse #3 and the pipe shop, should continue to be handled by local equipment. In most cases, these moves are bagged items of less than a pallet size and can either be hand walked to the pipe shop or a small, hand pulled wagon or bicycle could be used. If a very conservative 10 minutes for loading and unloading each pallet from a mule train is assumed, 7.3 manhours on average would be required per shift to handle 44 pallets. Assuming a 6.5 mile per hour average rate of speed, the entire yard could be traversed in approximately 45 minutes or .75 hour. Therefore, one very long fast "mule train" of 22, 4 ft. x 8 ft. trailers could conceivably handle the load. However, in reality, more flexibility is needed. It would be better to have two (2) mule

trains with, say 11 trailers each*, running per shift from the warehousing area. These trains would also be able to handle the movement of small painted parts from the roto-blast area to yard storage. This analysis will be modified later under "sheet metal."

Rush order parts that cannot be fitted into a standard delivery schedule would be handled by a central transportation department.

7.5.3 Pipe Shop

The analysis of the pipe shop shipments indicate an average of only 3.6 pipe baskets a day to any one of four (4) separate delivery points. It should be noted that this level of shipments was "taken from data recorded for the weeks 5/20/85 through 6/10/85. This was a somewhat higher production level than was averaged during the June - July, 1985 period when the pipe shop schedule was phasing down.

pipe shop deliveries do not experience the same delays as other areas of the yard. Since there is little time wasted during loading and unloading, it is recommended that a heavy duty, stake body, flat bed truck be used for this purpose. Such a truck already exists at Avondale and no new purchase would be required. The truck used for this purpose should be limited to carrying two (2) pipe baskets. The truck should have a capacity of at least 14,000 lb. net load weight.

*Increased to 12 each - see notes under sheet metal shop

It is recommended that the truck be located in a central transportation pool and only be called for by the pipe shop when there is a load ready for pick-up. The number of daily trips carrying fabricated pipe made by the shop does not justify keeping a truck full time at this location.

7.5.4 Fabrication Shops, Platens 1,2,3, and Blacksmith shop

The total number of skids transported from the subject areas averages under 16 per day. These are generally handled by leaving two (2) empty 40 ft. trailers in the appropriate areas and calling for their removal when full. Daily average of the 16 skids: 6 skids/shift go to yard storage

5.2 skids/shift to to blast area K

4 skids/shift to to roto-blast area

Due to the high cost of maintaining equipment as outlined under yard storage? it is suggested that the practice of leaving empty trailers as storage devices could be eliminated, although it has worked fairly well at Avondale. When a load suitable for a stake body truck is ready, a suitable truck should be dispatched from a central transportation function. The small number of pallets being moved does not justify the use of special equipment. With both the fork truck drivers and the transport vehicles under a central control authority, little time should be wasted for the load/unload functions.

This change will save a minimum of two (2) trailers and approximately \$9,000/year in maintenance and depreciation costs.

There will be some minor double handling of materials using this method but this should not be significant when compared to the reduction in trailers and the benefits of a centralized transportation system.

7.5.5 Sheet Metal Shop and Roto-Blast Area

Similar to the fabrication shops, two (2) empty trailers are generally kept in the sheet metal shop area for materials. Shipments average approximately 24 skids per shift with over 80% of these going either to the roto-blast area or to yard storage. Almost 47% of this material is "M2" Class or formed, light, bulky type sheet metal parts and assemblies. Given the nature of the load, the location of the sheet metal shop, and only a few delivery points not serviced by the proposed warehouse mule train, it is recommended that this shipment activity be combined with a new warehouse mule train activity.

Combining daily pallet requirements with warehousing and the roto-blast area yields:

Sheet metal	24 skids/shift
Warehouse	44 skids/shift
Roto-blast	22 skids/shift
TOTAL	90 skids/shift

All of these areas share deliveries and/or pick-ups. Standard times can be used of .03 hour max. for loading and another .03 hours for unloading skids from the mule train. Also, if a 15% allowance is added, this brings the total to .07 hours per skid or 4.2 minutes each. If it is assumed that the

train only averages 3.25 miles per hour, a train could make a complete circuit in 88 minutes. If two mule trains are used with 23 pallets each per trip for 2 trips each per shift:

Time for each round trip =

$$(23 \text{ skids} \times .07 \text{ hr/skid}) + 88/60 \text{ hr/trip} = 3.08 \text{ hours/trip} \\ \times 2 \text{ trips/shift} = 6.16 \text{ hours/shift}$$

Therefore, two mule trains consisting of say 12 carriers each could handle all of the skids currently being shipped from the warehouses, the sheet metal shop and the roto-blast area. Although no over capacity situations are anticipated, any that develop could be covered with the centralized transportation department's pool of trucks.

This will eliminate the need for having an average of two (2) flat bed trailers, stationed at the sheet metal shop. Similar to the fabrication shops, this will save an additional \$9,000/year in maintenance and depreciation costs.

7.5.6 Machine Shop

During the course of the study, very little material handling and moves were reported by the machine shop. They were averaging just under 7 trips per week using a stake body truck from the dispatching warehouse. Even this small amount of truck traffic only averaged 2.1 pallets per truck load. There were some heavier tractor/trailer type loads, but these only averaged three trips per week.

It is recommended that no fundamental changes be made in

material movements from the machine shop. These moves should continue to be handled by dispatching trucks on an as needed basis from a central pool.

7.5.7 Plate Shop

The survey data indicates that on any typical day, shipments from the plate shop will be directed towards the following 15 activity areas:

Wet Dock #2	Wet Dock #3
Blacksmith Shop	Warehouse #1
Machine Shop	Yard Storage
Platen #2	Platen #10
Platen #14	Platen #16
Platen #19	Platen #20
Platen #23 and #24	Area 307
Fabrication Shops	

Due to handling problems associated with delivering horizontally stacked large plates, most trucks will be loaded for single delivery points only. There will be no other scheduled stops along its delivery route. The plate shop developed their own survey sheet which differed somewhat from the one used throughout the rest of the yard. An example is shown in Exhibit VII-13. Their information also included the weight of individual loads wherever possible.

Small steel details are generally collected and shipped in empty 5 gallon paint cans. No problems are foreseen with this

container method. There is a long term possibility of the smaller containers being phased out in favor of larger ones. In that case, small wire basket containers or similar items would need to be purchased for handling small steel parts.

The current practice of laying plate horizontally on flat beds (trailers or stake body trucks) for one drop-off point only causes sub-utilization of these carriers. The principal reason for this policy is that if the upper plate on the horizontal load cannot be dropped off at its delivery point in a timely manner, the next delivery area would have to remove that particular plate to get at the one(s) they need. Also, space needs notwithstanding, there is no incentive for personnel at the second delivery point to place the removed upper plate back on the truck.

Fixtured trucks were considered that would allow edgewise, vertical stacking of plate. This could allow maximum utilization of carrier capacity and could expand delivery points, however, other problems would develop. Principally, the weight and costs of the fixtures themselves would not be insignificant compared to any potential increase in trailer utilization. If there is central control over loading and unloading of trucks, plates could be mixed horizontally and deliveries could be controlled by the central dispatch authority. This is a better solution than designing hardware to circumvent the problem. Potential savings from centralized control will be developed later in this report.

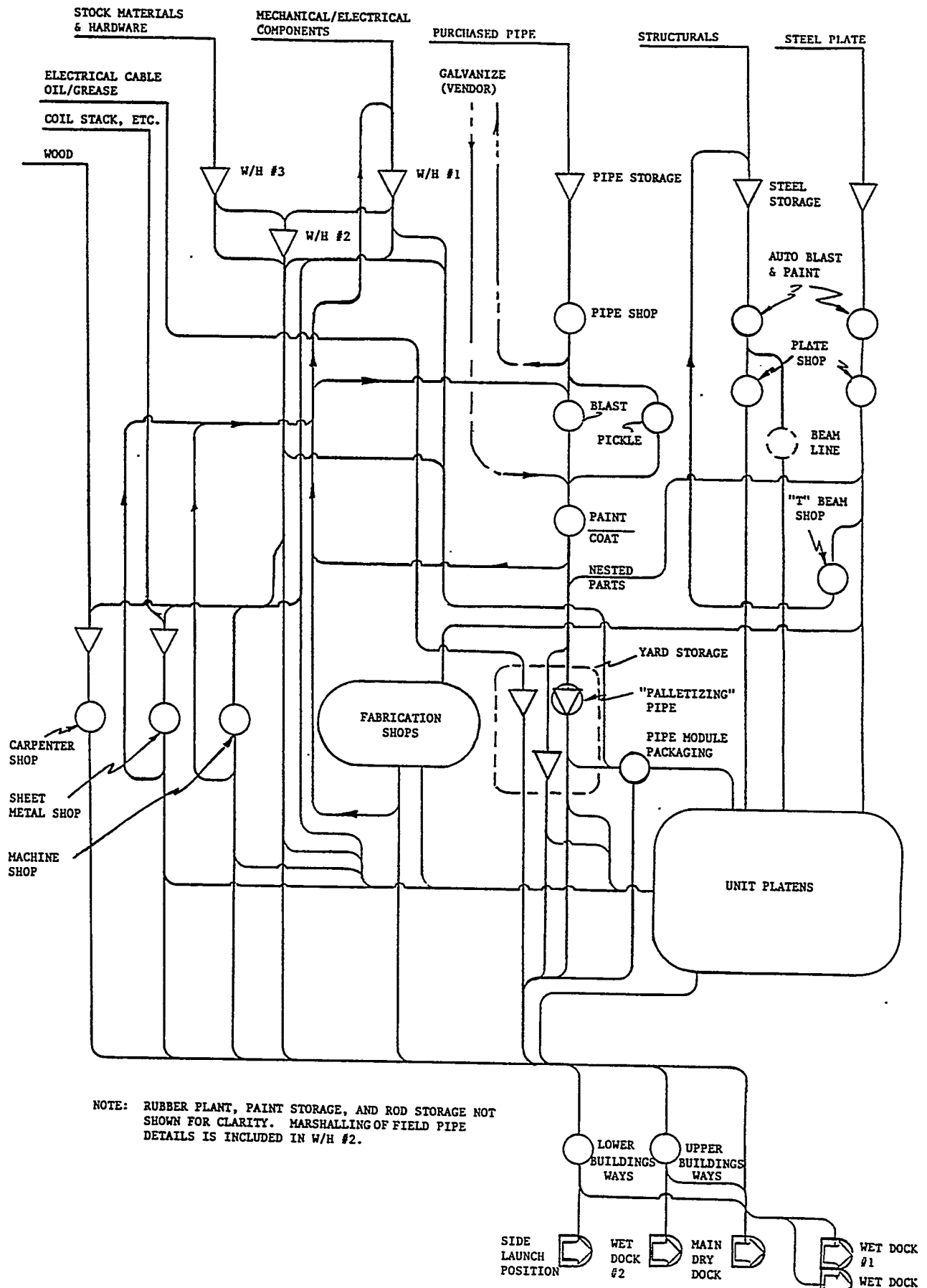
7.5.8 Summary of Section 7 Recommendations

- a. Although the practice of using flat bed trailers as storage devices has worked fairly well? eliminate it where practical to reduce trailer maintenance costs.
- b. Purchase a special material handler similar to a Gradall "Loed" vehicle which has both fork lift and fifth wheel attachments. The vehicle must be designed and equipped to negotiate levee inclines with a 40 foot loaded trailer in tow. Net static loads should normally be under 20,000"lb.
- c. Equip a few flat bed trailers to hold the fork lift attachment while being towed by the "Loed" handler.
- d. Eliminate two (2) yard jockeys.
- e. Implement a two (2) mule train (12 trailers each) transport system for handling light loads transported from the warehouses, sheet metal shop, and roto-blast area.
- f. Service the Pipe Shop, Plate Shop, Machine Shop, Blacksmith Shop and Fabrication Shops with a centralized transportation department.
- g* Begin phasing out unutilized flat bed trailers previously used for storage.

EXHIBIT VII-1

25 June, 1985
RMA 85329
EJP

OPERATION PROCESS CHART



BUILDING NUMBERSZOHE 100

101 Boiler and Ray Marse Hose Repair Building (60'x25')
102 W.D. #1 Elec. Fab Shop & Shipfitting Tool & Storage Bldg (215'x60')
103 First Aid Station No. 2 & Customer's Bldg (68'x33')
105 Shock Test Building (35'x35')
106 Porter Service Supply Room (20'x20')
107 Cafeteria - Portable (25'x25')
108 Pipe Storage Area (30'X30')
109 Sheet Metal Shop (445' x 1000')
110 Carpenter Shop & Storage (300'x75')
11.2 Whse #2 (2nd floor Quality Control) (370'x70')
113 Whse #3 & Moldloft (600'x70')
114 Welding Rod Storage Building (100'X55')
11.5 Electronic Control House - Portable (8'x8')
116 Machine Shop (540'x95')
117 Pipe Assembly & Packaging Bldg. (158'xI.52')
118 Pipe Shop (290'xi98')
119 ASI Training Center & Handrail Plant, Door Plant & Photo Shop (Ind. Hyg.) (Old Avoncraft) (290'xI.00')
120 Paint Shop (80'x60')
121 Platen No. 21.
122 Kolene Plant (60'x22')
123 Shipfitter's Platen Office (20'x15')
1.24 Fabrication Bldg. Platen No. 21 (225'x65')
125 Guard House at Engineering No. Parking Lot (7'x6')
3.26 Rod Storage Bldg. in Warehouse No. 3 (75'x60')
127 Q&I Mobile Sound Laboratory (trailer) (20'x8')
128 Pipe Shop Receiving Office (20'x10')
129 Pipe Rack Office (20'xI.2')
130 Drafting and Hobby Shop Building (30'x31*)
131 Carpenter Spray Building (29'x16')

132	W.D. No. 1 Paint and Storage Bldg. (28's25')
133	Night Pipe Ship ??oxeman Bldg. (12'x10')
134	Rigging Shop Wet Dock No. 1 (70's60')
135	Whse. Night Receiving Office (Whse. #3) (20'x10')
136	Rod Room No. 16 (Portable Steel Bldg.) (30's16')
137	Portable Field Office, Elec. Dept. (12's30') Steel
138	Tank Testers Field Office W.D. No. 1 (10'x20') Steel
140	Rest Room Platen No. 21 (16's24')

ZONE 200

201	Platen No. 1
202	Platen No. 2
203	Platen No. 3
204	Engineering Office (triple trailer) (36'x64')
205	Engineering Bldg. No. 1 (250'x60')
206	Estimating Office Building
207	ILS Office (60'x25')
208	Oxygen Plant (Air compressor bldg.) (85'x50')
209	Production Bldg. (105'x70')
210	Coast Guard, Credit Union, & Hopeman Bros. (100'X20')
21.2	Customer's Office (25'x25')
213	Cafeteria (259X25')
214	Fabrication Shop No. 2 & Blacksmith Shop
215	L.N.G. Facility Bldg. (41'x208')
221	Superintendent's Office (35'x20')
222	W.D. No. 1 -Rest Room (25'x10')
223	Insulation Dept., W.D. No. 1 Office Bldg. & Tool Room #3 (1.20'x80')
224	Pipe Shop W.D. No. 1 (100'X25')
225	Outside Machine Shop W.D. No. 1 (30'x25')
226	Ship Operator's Office, Elec. Shop & Sheet Metal W.D. #1 (50'd.5')
227	Plant Storage Bldg. (50'x35')
228	Engineering Bldg. No. 2 (100'X75')
229	Electrical Dept. & Shop No. 1 Building (130'x120')
230	Supervisor's Office
232	Guard House at Personnel Gate (6'x8')
233	Platen No. 1 Work Shop (20'x100')
234	PlatenNo. 1Work Shop (34'x30')
235	Dry Dock Superintendent's Office (23'x39')
236	Guard House next to Bldg. 206 in Parking Lot "B" (6'x8')
238	Clock House beside Shop No. 2 (levee side) (18'x12')
239	Portable Bldg. W.D. No. 1 Boiler site (24'x9')
240	Personnel Bldg. (141'x60')
241	Carpenter Shop, Storage Bldg. (36'xI.5')

242 House over Generator at Main Gate (16-1/2'x17-1/2')

243 Security Guardhouse Gate 5 (6-1/2'x4-1/2')

253 Engineering Bldg. No. 3 (90'x91')

254 Platen1A Office (17'x10')

255 Printing Dept., Mail Room, & Customer's Night Supt. (80'x35') Payroll
- ID Badge

256 Rest Rooms - Portable (24'x12')

257 Tool & Rod Room - Portable (20'x16')

258 Foreman's Office Bldg. - Portable (30'x12')

259 Paint Storage Bldg. (58'x25')

262 Field Office - Pipe Shipfitter's (12'x8')

264 Guard House next to Production Bldg. (7'x11') Steel

ZONE 300

301 Area Superintendent's Office (74's35')

302 Welding Supt. Office, Safety Office, & First&d (140's34'+)

303 Rest Room - Boiler Site (30's25')

304 Platen No. 4

305 Platen No. 5

306 Platen No. 6

307 Platen No. 7

308 Platen No. 8

309 Platen No. 9

310 Platen No. 10

311 Boiler Site Bldg. (360'x80')

312 Shipfitter's Foreman Office (15'x10')

313 Blast Area Work Bldg.

315 Portable Rest Room (24'x12')

316 Compressor Bldg. #1 (35'x16')

317 Rod Room #19

318 Boiler Site Tool Room

319 Platen No. 19

320 Portable Rest Room (24'x12')

321 Electric Fab Shop (16'x36')

322 Sound Proof Bldg - Portable

323 Paint Storage Bldg. Blast Area "B"

324 Rod Room #17 - Portable Bldg.

327 Ladies Rest Room - Portable (24'x12')

329 Bldg. Platen No. 8 - Portable (24'x12')

330 Supervisor's Office

331 Electric Field Office (14'x13')

335 Construction Serv. Field Office-First Track (levee side) (16'x12')

337 Rigger's Field Office - First Track (levee side) (12'x10')

338 Rod Room No. 3 (downriver end) Platen No. 6 (18'x12')

339 Tool Room No. 2 & Rod Room No. 2 (storage) (20'x17')

340 Shipfitter's Field Office (36'x10-1/2')

341 Machinist Storage Bldg. - Second Track Position No. 2 (17'x16')

342 Shipfitter's Field Office - Second Track Position No. 2 (20'x.2')
343 Maintenance Field Office (upper yard) (17'd.8')
344 Maintenance Electric Office (upper yard) (19'x18')
349 Cornet Construction Office (7'x7')
350 Upper Yard Pipe Foreman's Office (20'X10')
352 Shipbuilding Area Bldg. & Sheet Metal Field Office (10'xI2')

ZONE 400

402 Compressor Bldg. No. 4 (75'x65')

404 Tool Room No. 11

405 W.D. No. 2 Field Office (16'x10') Steel

406 Tool Room No. 5 (upriver end) Platen No. 22

410 Rod Room No. 15

411 Platen No. U

412 Rotoblast Bldg. (80's49')

413 Platen No. 13

416 Platen No. 16

420 Rest Room (lower yard) Portable (12'x15')

422 Portable Rest room (lower yard) Construction Area (24'x12')

423 Electrical Field Office (18'x10')

424 Pipefitter's Field Office (17'x13')

425 Fitting Office (lower yard) (10'x10')

ZONE 500

501 Office Bldg. -W.D. #3 (185'x40')

502 Scaffold Repair Bldg. (55'x50')

503 Boiler Bldg. (60'x40')

504 Lower Shipbldg Area, Paint Supt., Rigging Supt., & Welding Foreman
(100'x20')

505 Wet Dock No. 3 -Rest Room (20'x50')

510 Compressor Room No. 5 (65'x50')

511 Rest Room (downriver end, W.D. No. 3 - Front of Bldg. 502)

512 Fabrication Platen No. X2 (Concrete Platen)

513 Cafeteria Bldg. -W.D. No. 3 (Front of Bldg. 502) (26'=1')

514 Gate W.D. No. 3 (7'x7')

515 Reach Rod Building (29'x28')

516 Hopeman Bros. Storage Room (80'x24')

517 Rest Room located in center of W.D. No. 3 Ramp

518 Generator House at Bldg. 503 (1.2'x6-1/2')

519 Herbert Hiller Office (10'x8')

520 Engine Assembly Bldg. (80'x46')

521 Hiller Chartres Corp. Office (19'x12')

522 Platen No. 22 (Concrete Work Area)

526 Rigger's Office W.D. No. 3 (80'x19')

527 Paint Storage Bldg. W.D. No. 3 (58'x15')

528 Capt. Curtis & Rigger's Office W.D. No. 3 and above 50 (32'x20')

529 Guard House - Gas Free Plant

530 Portable Rest Room on Platen 21

532 Sheet Metal Field Office - Portable (10'x1.2') Steel

533 Hopeman Bros. Field Office, W.D. No. 3, (next to levee)

534 W.D. No. 3 Machinist Storage Bldg. (Steel) (18'x10')

535 Rigger's Storage Bldg. (24'x24') Steel

536 Electrical Storage Bldg. (24'x24') Steel

537 Sheet Metal Storage Bldg. (24'x24') Steel

538 Pipefitter's Storage Bldg. (24'x24') Steel

539 Pipefitter's Storage Bldg. (24'x24') Steel

540 Outside Machinist Storage Bldg. (17'x73')

ZONE 600

601 Warehouse No. 1 (665'x230')
602 Pipe Assembly Building "
604 Guard House - Gate No. 7
605 Guard House - Gate No. 8
606 Tool Room No. 14 W.D. No. 3
607 Scrap Office - Portable (9'x1.3') Steel
609 Cable Stripper Bldg. (30'x1.6')
610 Timekeeper's Office, North side Administration Bldg. (36'x36')
620 Pipe Storage Field Office (Steel) (20'x20')

ZONE 700

- 701 Security Office - Main Gate (118'xJ5')
- 702 Utility Building
- 703 Administration Building
- 704 Hydraulic Equipment Building
- 705 Power Supply Building
- 706 Tool Room
- 707 Automotive Repair Shop and Office,. Fire Station Office & Bike Repair Shop
- 708 Guard House next to Admin. (8'x8')
- 709 Grease Crew Field Office
- 711 Maintenance Department - Paint Storage Building (20'~0')
- 71.2 Records Building (60'x56')
- 714 Brick Veneer House - Across from Gate No. 5
- 715 Tire Repair Office
- 717 Guard House Gate No. 7
- 718 Mayo House - 5125 River Road - Wood - Engr. Office (20'x30')

ZONE 800

801	Storage Building
802	Office Building
803	Rest Room
804	Rod Room
805	Beam Line Building
806	Office Building
807	Plant Engineering and Maintenance Building
808	Storage Building
811	Storage Building
812	Office Building
813	Storage Building
814	Storage Building
815	Tool Room No. 10
816	Maintenance Storage Building
817	Platen No. 17
818	Platen No. 18
820	Platen No. 20
821	Tool Room & Toilet (Platen No. 17)
822	Tool Room Platen No. 20
823	Bathroom Platen No. 20
824	Rod Room Platen No. 20 - Up River
825	Bathroom Platen No. 20 - Up River
826	Office Building - Platen No. 20
827	Blast & Paint Bldg. Area "B"
828	Rest Room Ladies - Portable
829	Janitorial Supply Bldg. - Back of Maintenance Building
830	Q.C. Office (next to Blast & Paint Bldg.)
831	Rest Room - Ladies - Platen 20
832	Panel Line Office Bldg. Plate Shop
833	Guard House at Gate 14
834	Crane Field Office - Platen No. 20
835	Welder's Field Office - Platen No. 20
836	Sewage Treatment - Inspector's Office

837 Fab Pipe Storage Office
838 Fab Pipe Shop
839 Supt. Office - Platen No. 17
840 P.E. & M. Workshop (28'x39') Steel.
841 Rest Room - Fab. Storage &ea
842 Platen No. 25 - Upriver end of Steel. Storage
843 Platen No. 26 - Upriver end Blast & Paint Building
880 Portable Tool Room
881 Portable Tool Room
882 Portable Tool Room No. 6 - Platen 25
883 Portable Tool Room - Platen No. 19
884 Portable Tool Room No. 17 - top of LASH No. 1 W.D. No. 3
885 Portable Tool Room
895 Portable Rest Room
896 Portable Rest Room
897 Portable Rest Room
898 Portable Rest Room
8 Portable Rest Room - at Offshore Yard

ZONE 900

901 Area Facility Building
902 Repair Department Office "
903 N.A.B. Welding School
904 Office Building
905 Paint Field Office (30*x12*) Wood frame corr.
906 Guard House Gate 47 (8'x8')
907 Plate Shop Building
908 Shotblast Building
909 Pickling Plant
912 Blast Equipment Building
913 Blast Storage Building
914 Platen No. 14
915 Platen No. I-5 "
916 Gate #47
917 Platen No. 14 - Formens Field Office
918 Steel Storage Office
919 Paint Shop
920 First Aid Lower Yard
922 Fiber Glass Building
923 Structural Blast
924 Rest Room Blast Area "K"
925 Guard House "K"
926 Paint Expediter's Building
927 Drum Storage Building Paint Storage
928 Rubber Plant
929 Solvent Building
930 T-Beam Fabrication Building
931 Burn Out House
932 Storage Building for Mold Loft (Templet Storage)
933 Blast & Paint Building, Area "D" (Steel Bldg., insulated/spray foam)
934 Welder's Office on Platen No. 24
935 Shipfitter's Office on Platen No. 24
936 Rigger's Field Office in new Storage Area
938 Guard House - Gate 2A
999 D.P.I. Building

YARD ACTIVITY AREAS - MATERIAL MOVEMENTSAREANO. AREA NAME

1. Warehouse No. 1 Main purchased parts storage and government furnished material.
2. Warehouse No. 2 Stock material storage and government furnished material.
3. Warehouse No. 3 Stock material, hardware, pipe fittings, door plant material and surplus material.
4. Pipe storage (RAW) stock pipe, job pipe, surplus.
5. Marshalling/Staging area - pipe details.
6. Yard fab pipe storage.
7. Drum storage/electric cable storage.
8. Fab part storage/pre-fab unit steel storage.
9. Sheet metal shop and associated storage.
10. Main pipe shop.
11. Main machine shop.
12. Pipe module shop.
13. Carpenter shop and associated storage.
14. Paint shop (near carpenter shop).
15. Fab shop #2/Blacksmith.
16. Wet dock #1.
17. Wet dock #1 shops.
18. Wet dock #2.
19. Wet dock #3.
20. Lower building and launch ways.
21. Main upper dry dock.
22. Plate shop.
23. Beam line building.
24. T-Beam building.
25. Pickling plant.
26. Rubber plant.
27. Blast/Paint/Area K.
28. Structural blast/paint.
29. Platen #1.
30. Platens #2/#3.
31. Upper building ways - Area 307, Platens #4 and #7.
32. Platens #5/#6.
33. Platens #8, #9, and #10.
34. Platens #11, #12, and #13.
35. Platens #14, #15, and #16.
36. Platens #17, #18, and #19.
37. Platen #20.
38. Platen #21.
39. Platen #33.
40. Platen #23 and #24.
41. Platen #25.
42. Platen #26.
43. Paint storage.
44. RotO-Blast.
45. E. Bank warehouse.
46. Blast house.

NOTE: The main steel storage area, rod storage, paint storage, and maintenance are not included.

Vehicle # 49 E TYPE TRAILER MATERIAL HANDLING SURVEY 7-11-85

MATERIAL DESCRIPTION	MAT'L CLASS	STARTING LOCATION	ROUTE		ENDING LOCATION	NO. OF UNITS/CONTAINERS/SKID	NO. OF CONTAINERS OR SKIDS	SIZE OR TYPE CONTAINER
			LEVEE	OTHER				
foundation	E	29	✓		storage	1	1	pallet
foundation	E	29	✓		storage	1	1	pallet
foundation	E	29	✓		storage	2	1	pallet
foundation	E	29	✓		storage	4	1	pallet
foundation	E	29	✓		storage	4	1	8x4 pallet
headers	E	29	✓		storage	7	1	pallet
headers	E	29	✓		storage	4	1	pallet
platform	E	29	✓		storage	1	1	8x4 pallet
platform	E	29	✓		storage	1	1	8x4 pallet
package unit	E	29	✓		modèle shop	1	1	pallet
platform	E	29	✓		storage	2	1	4x8 pallet
platform	E	29	✓		storage	1	1	pallet
platform	E	29	✓		storage	1	1	pallet

USE ATTACHED LISTINGS FOR DETERMINING MATERIAL CLASSES

RMA 85329
ETP 14, JUNE 1985

NOTE! ON MAT'L CLASS F, G, G2 & L2: PROVIDE A.S.I. NUMBER OF LOADING EQUIPMENT USED TO LOAD TRANSP.

MATERIAL HANDLING SURVEY

DATE

7-10-85

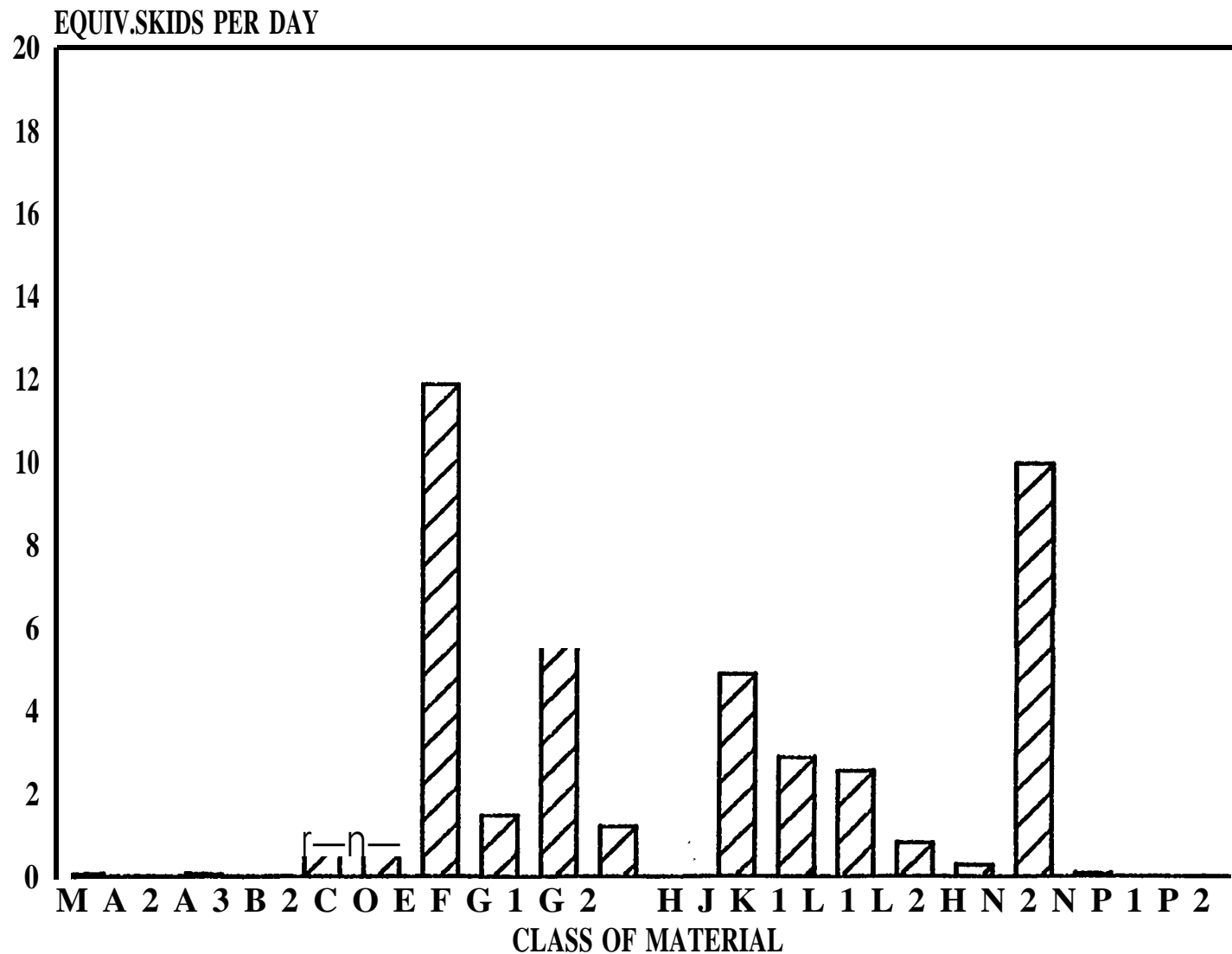
SMALLEST UNIT/UNIT OF MATERIAL (e.g. PIPE, BOX, BAG)	MATL CLASS	STARTING LOCATION	ENDING LOCATION	LEAVE RD ROUTE?	HANDLING EQUIP USED TO LOAD XPORT VEHICLE	TYPE/SIZE OF CONTAINER AND/OR SKID PER CONTAINER FOR VEHICLE	NUMBER OF CONTAINERS PER VEHICLE	NUMBER OF CONTAINERS PER VEHICLE	TYPE OF TRANSPORT VEHICLE
1 Pallet	C	Whse #1	WD #3	✓	4000# L/T	4x4 Pallet	4		
Nuts & Bolts									
1 Box @ GRINDER WHEELS	D	Whse #1	WD #3	✓	4000# L/T	"	1		
1 CRATE @ CLEANING MACH	E	Whse #1	WD #1	✓	"	4x3 CRATE	1	6	STAKE Body
1 Elec Panel	E	Whse #1	Plat #302	✓	"	4x4 Pallet	1		
1 Pallet									
Pipe Fittings	D	Whse #1	Plat #302	✓	"	4x4 Pallet	4		
Dish Head	E	"	Boiler Site	✓	"	4x8 Pallet	1		
"	E	"	"	✓	"	"	1	4	STAKE Body
"	E	"	"	✓	"	4x4 Pallet	2		
"	E	"	"	✓	"	"	4		
1 Pallet Elec Parts	C/D	Whse #1	WD #3	✓	4000# L/T	4x4 Pallet	6		P/U
MAINT			MAINT						
SUPPLIES	C	"	WNSC	✓	"	"	7		
DISH HEAD	F	Whse #1	Boiler Site	✓	4000# L/T	4x8 Pallet	1	1	STAKE Body
"	F	"	"	✓	"	"	1	1	

ROUTE	CLASS OF MATERIAL																			TOTAL
	AI	A2A3	B2	C	D	E	F	(31	G2	H	J	K1	L1	L2	M	M2	N	P1	P2	
8 TO 31				9	1	58	6	25	10		32		12		4	7				164
8 TO 37	1			1	4	58	6	15	1		17		3			52				158
8 TO 33				1		32	1					e				90				137
B TO 35			1			10	3	33					2	6						51
8 TO 18												25								25
8 TO 41				1		4		9	5		2		2							21
8 TO 19									1			10	2							14
8 TO 36						5	1						7							13
8 TO 17											12									12
8 TO 15													10							10
8 TO 30						4	3				1		1							8
8 TO 16					2						6									8
8 T O 9					1	5		1	1											8
8 TO 40						1		3			2		1							7
8 TO 22														5						5
8 TO 34				1										.1						2
8 TO 38						1														1
8 TO 29							1													1
8 TO 27								1												1
8 TO 12																	1			1
8 TO 42											1									1
15dsTOTAL	1	0	1	0	13	8	178	22	87	18	0	73	43	38	12	4	149	1		646
6 TO 37				12B																128
6 TO 31				82																82
6 TO 35				41																41
6 TO 33				16																16
6 TO 38				14																14
6 TO 40				9																9
6 TO 41				3																3
6 TO 27				2																2
6 T O 4 2				1																1
15d,TOTAL				296																296
TOTALS/DAY	0,0	0	0,0	19.	0.0	0.5	11.	1.4	5.0	1.2	0	4.8	0,8	2,5	0.8	0,2	9.9	0.0	0	62.93333
FR,YDeSTOR,																				

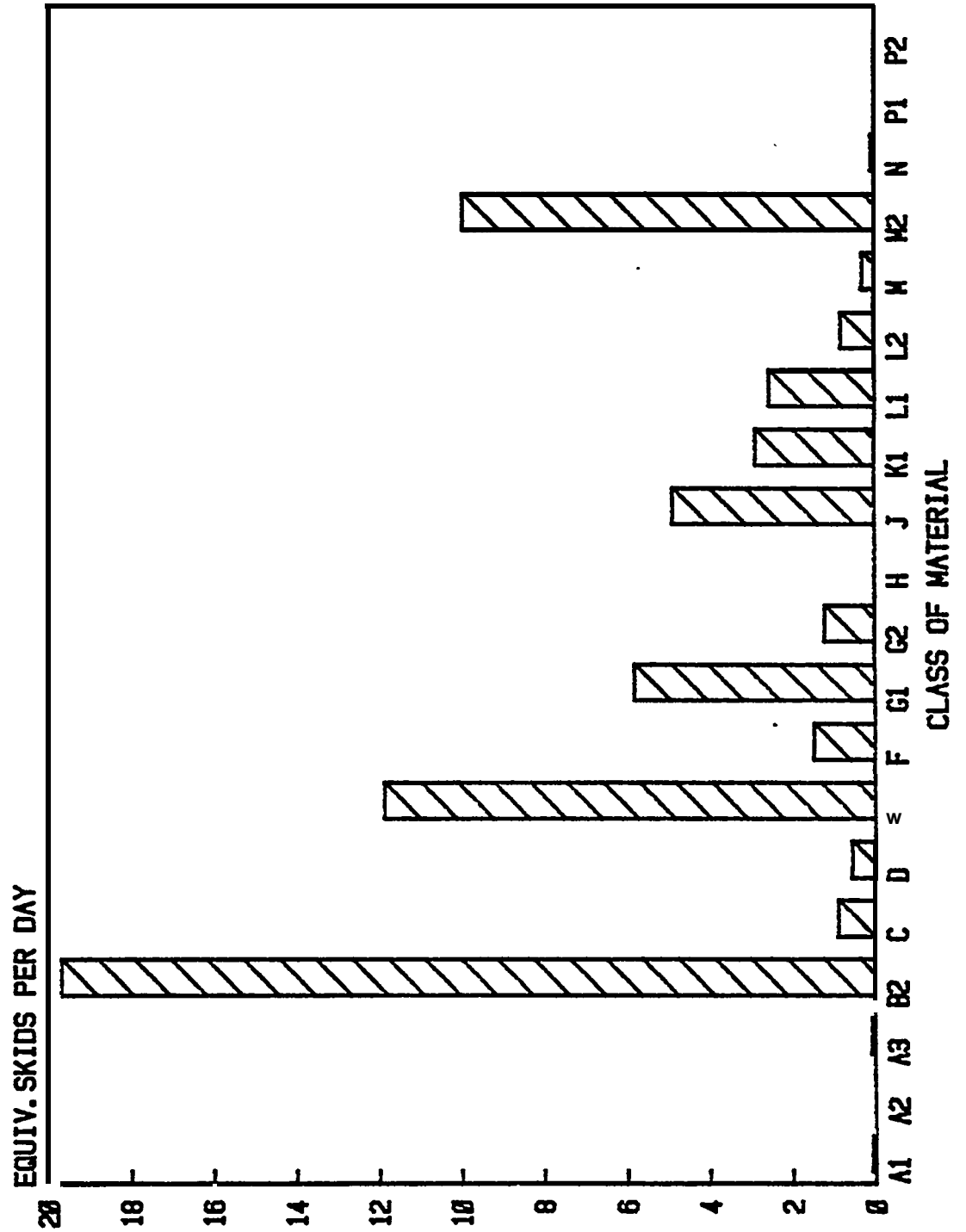
EXAMPLE OF SPRLAD SHEET DATA FROM YARD STORAGE

SHI PYARD MOVEMENT SUMMARY

MOVES FROM FAB. PARTS YD STORAGE

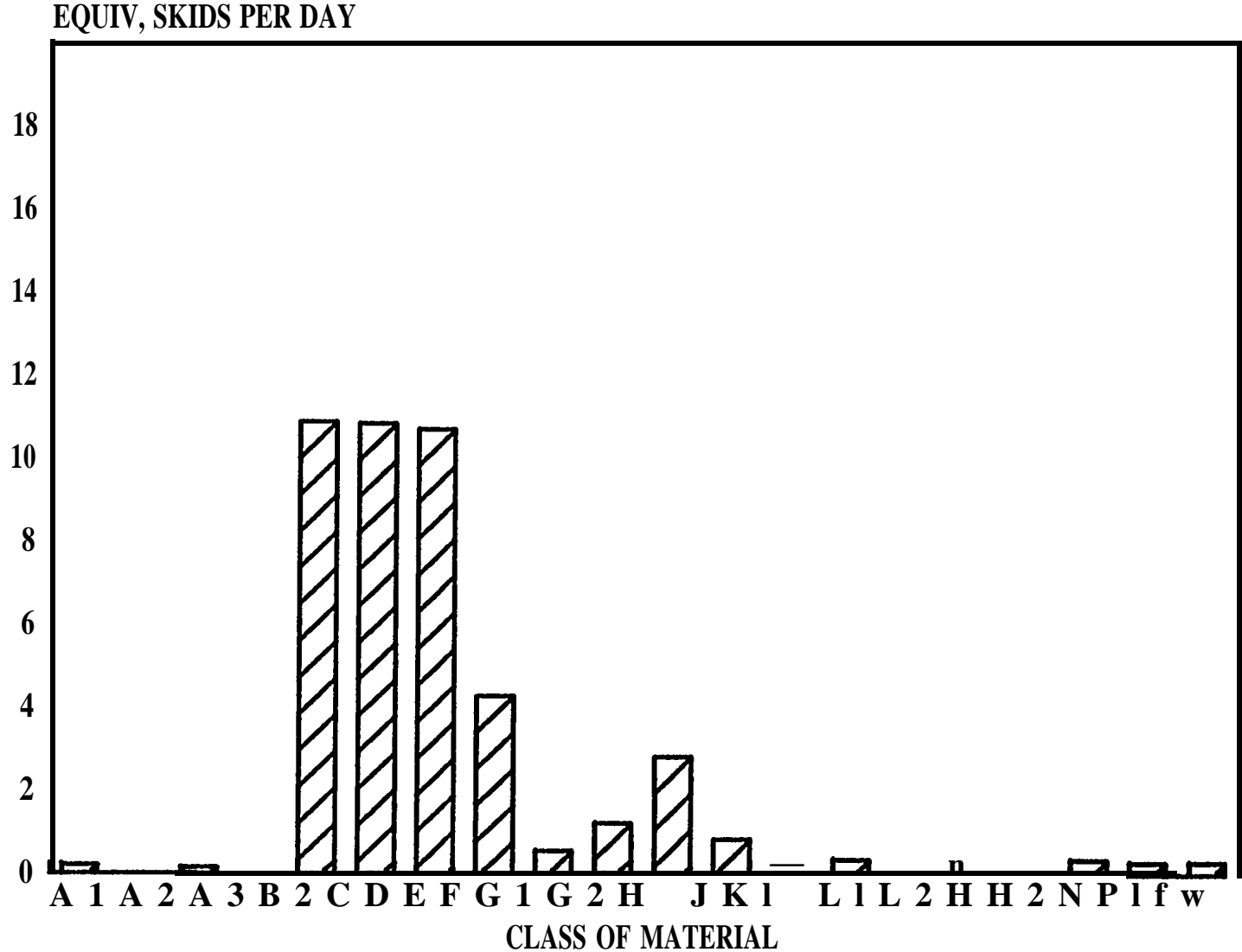


SHIPYARD MOVEMENT SUMMARY FROM YD STORAGE INCLUDING PIPE



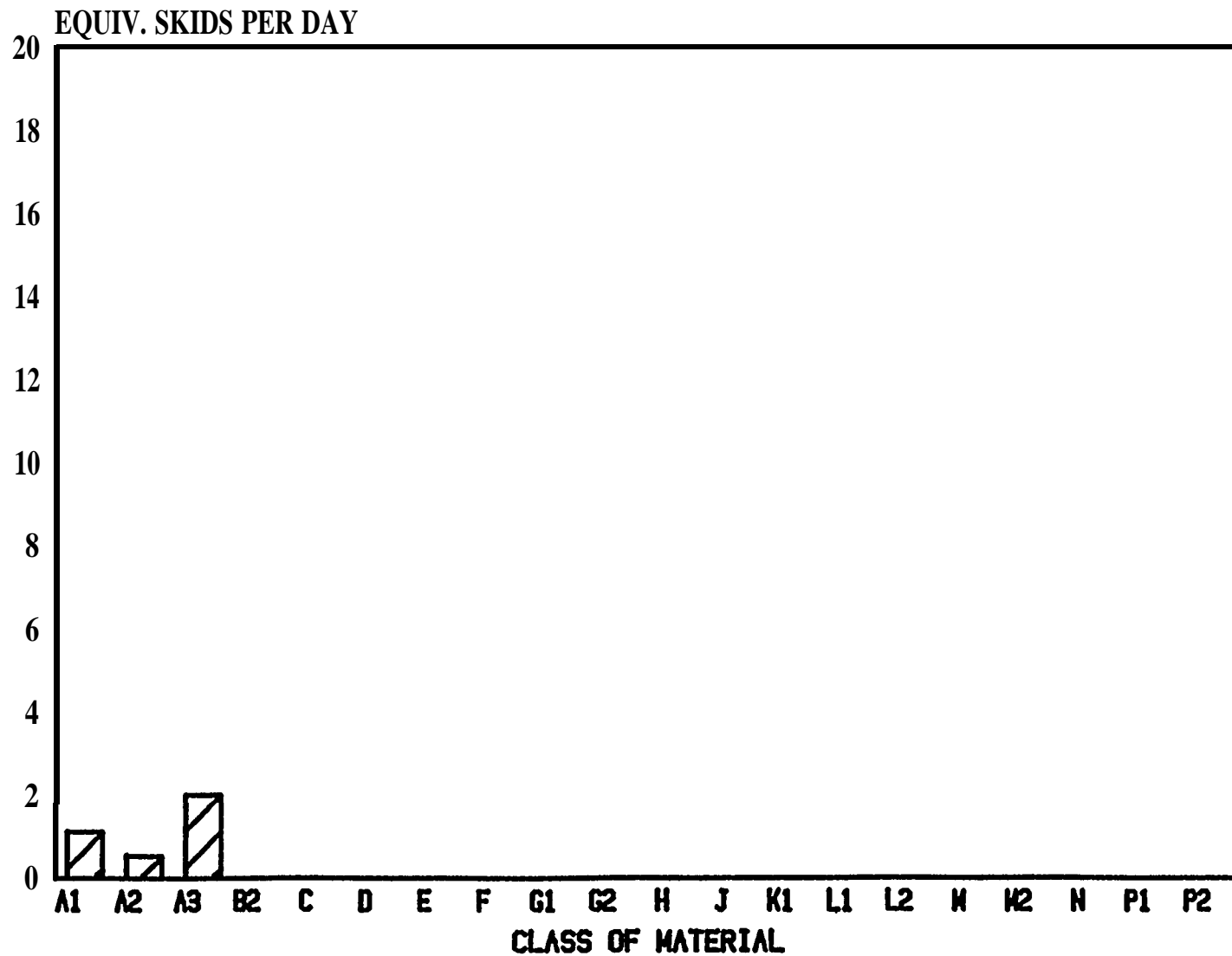
SHI PYARD MOVEMENT SUMMARY

COMBINED WAREHOUSE MOVES-MAIN YD



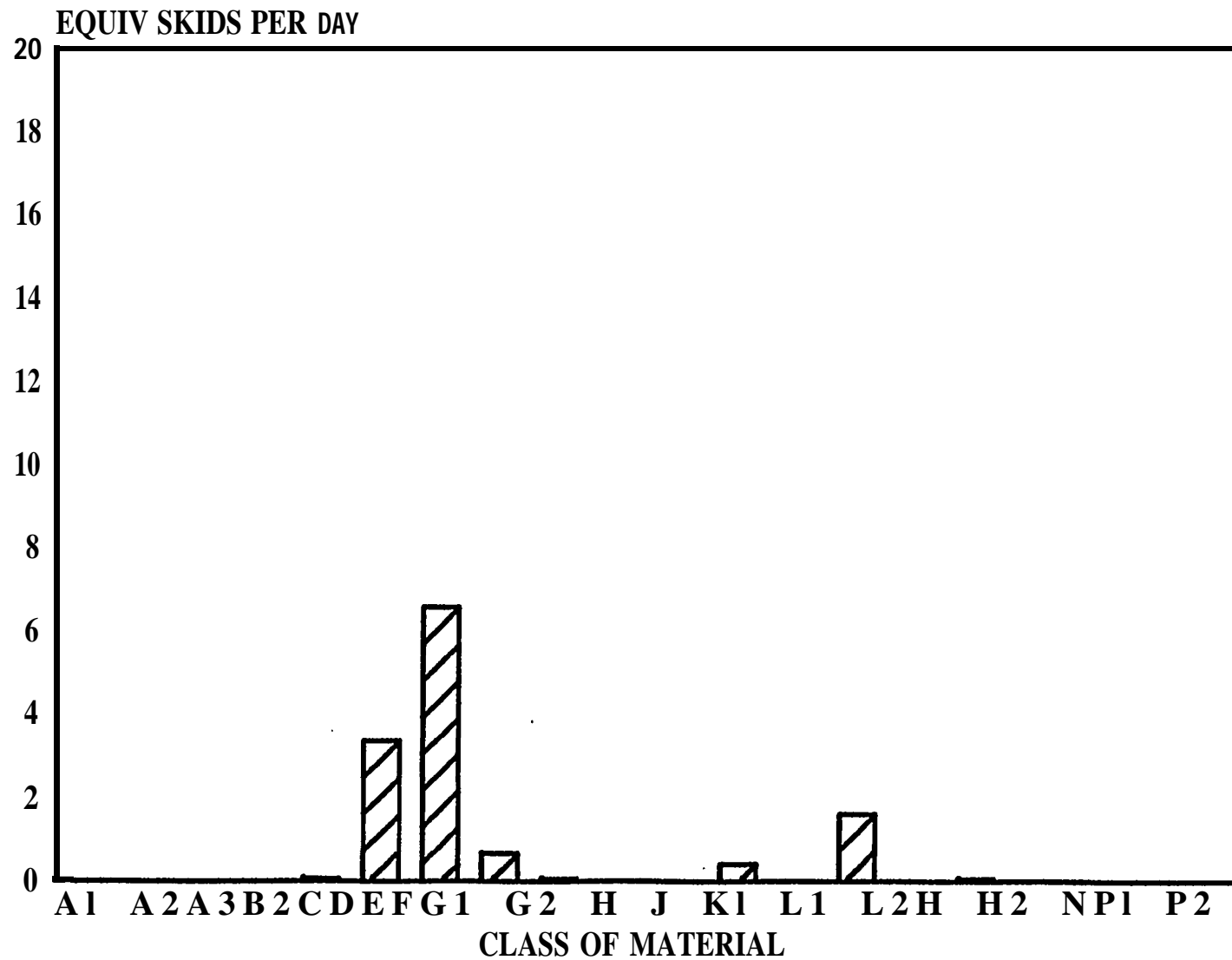
SHI PYARD MOVEMENT SUMMARY

MOVES FROM THE PIPE SHOP



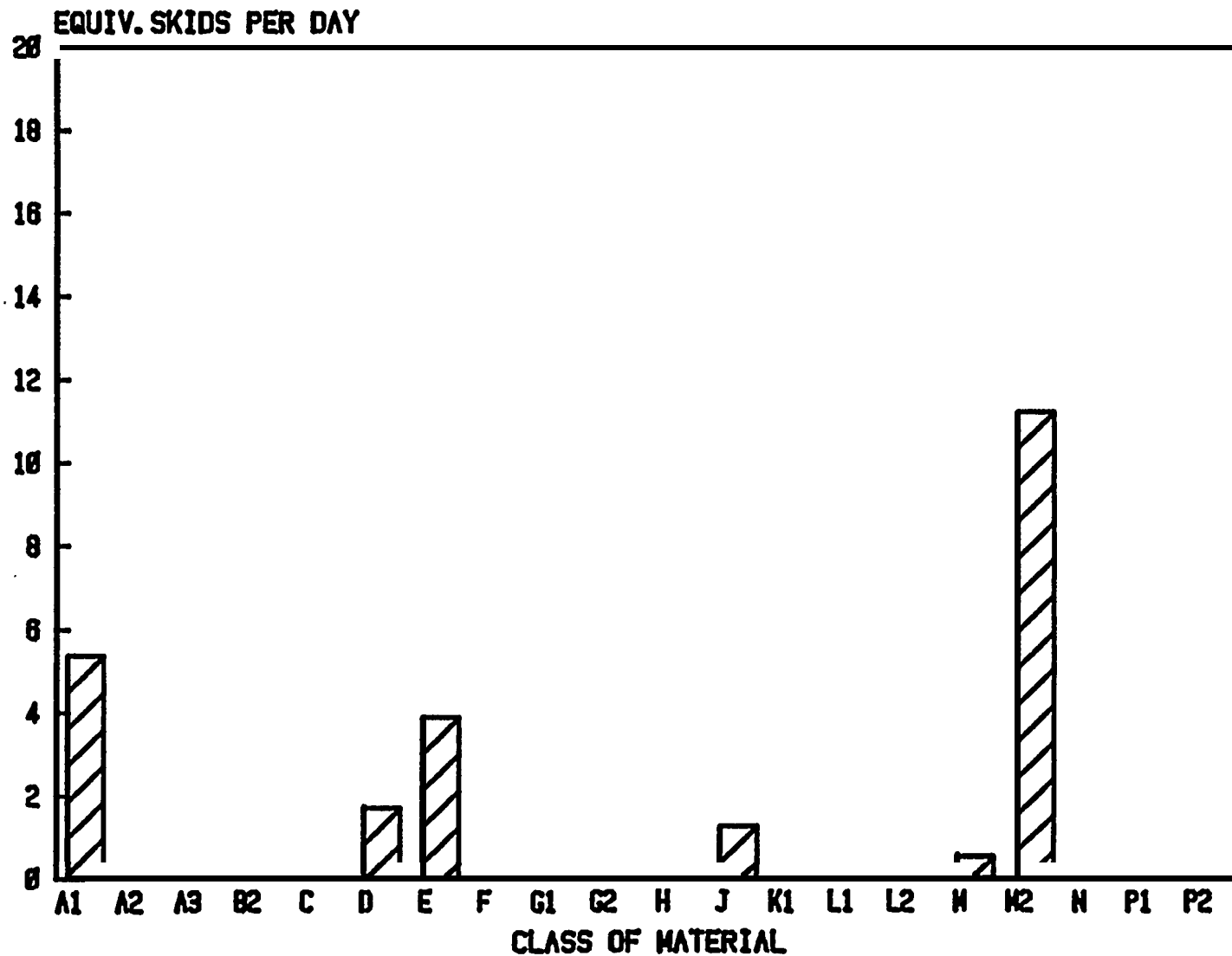
SHI PYARD MOVEMENT SUMMARY

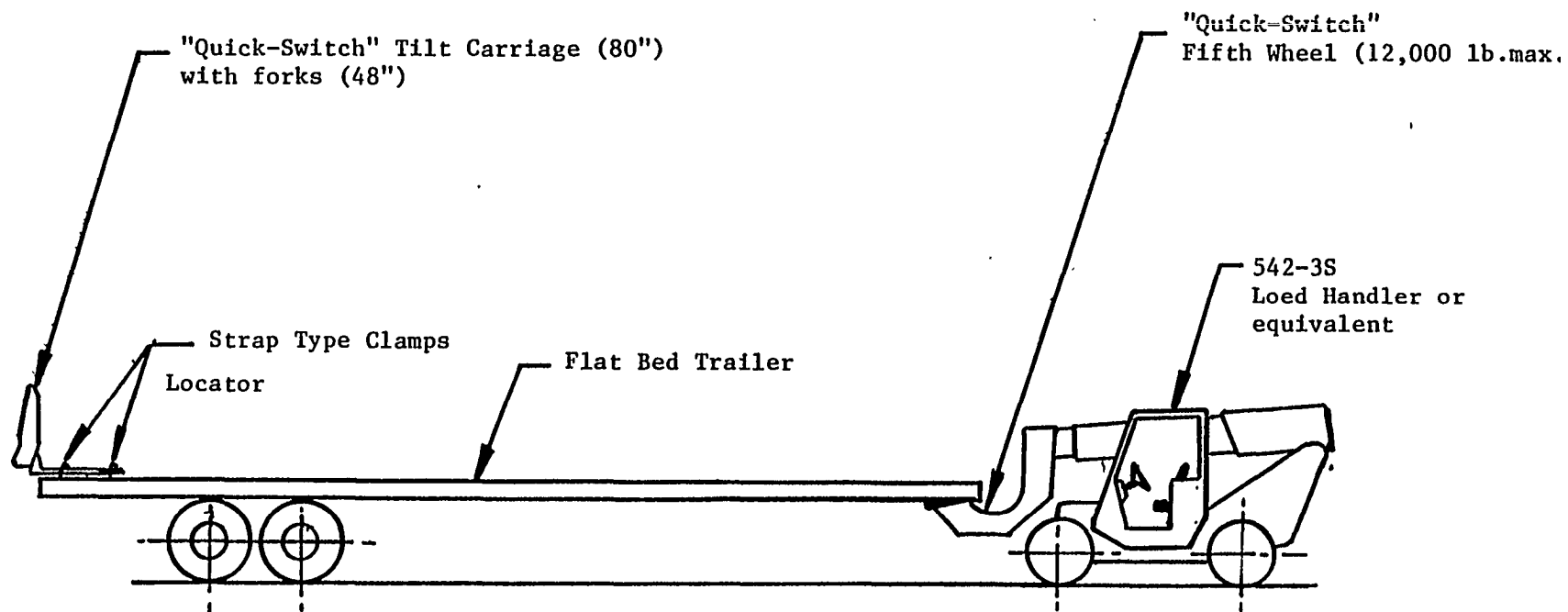
MOVES FROM UPPER YARD FAB SHOPS



SHIPYARD MOVEMENT SUMMARY

MOVES FROM THE SHEET METAL SHOP





SELF-LOADING - UNLOADING VEHICLE WITH
"QUICK-SWITCH" ATTACHMENTS

PALLET S.
 MED. SIZE
 FULL SIZE

PRE-FAB DEPT. MATERIAL HANDLING SURVEY

DATE: 7/1/85

PIECES CATEGORY	TYPE OF MATERIAL	FROM	TO	LEVEL ROAD ROUTE?	EQUIP USED TO LOAD EXPORT VEHICLE	TYPE & SIZE OF CONTAINERS AND/OR SKIDS	UNITS COUNT PER CONTAINER	PER LOAD	WGT.	TYPE TRAN VEH
SMALL	PL'S	SHEAR	PLAT 23	X	FORK LIFT	PALLET	45	1	262	ST.
SMALL	PL'S	SHEAR	PLAT 20	X	FORK LIFT	—	148	1	416.5	—
SMALL	PL'S	—	—	X	—	BUCKET	2	1	10	—
—	—	—	—	X	—	—	2	1	2	—
—	—	—	PLAT 19	X	—	—	1	1	4	—
—	—	—	PLAT 14	X	—	—	1	1	3	—
—	—	—	—	X	—	—	3	1	16	—
—	—	—	PLAT 24	X	—	PALLET	2	1	61	—
—	—	—	—	X	—	—	2	1	61	—
—	—	—	PLAT 20	X	—	BUCKET	2	1	31	—
—	—	—	PLAT 23	X	—	PALLET	11	1	345	—
—	—	—	—	X	—	—	8	1	250	—
Small	PL	SHEAR	PLAT 16	X	Fork Lift	Pallet	9	1	298	—

8. PERSONNEL TRANSPORT ALTERNATIVE

8.1 Shuttle System

An alternative to the present motorcycle and pickup truck personnel transportation system would be the use of van type, continuously running motor vehicles tracing the path shown in Exhibit VIII-1.

Assuming 14 stops at 20 seconds each and an average running rate of 13 miles per hour, a van type vehicle would be able to make this circuit in just over 19 minutes. If 22 minutes is assumed as an average with contingencies, and four vans are in the system, no one would need wait more than 5.5 minutes for a van. This figure assumes full stops at 14 points and full use of contingency time.

At least two of the above four vans could be eliminated if scheduled stops were made, say, each 22 minutes at the 14 various stops. Scheduled stops are preferred over continuous 5.5 minute interval van sequencing.

A 1-1/2 week study was performed of the personnel traffic on the levee road using motorcycles and pickup trucks. A combination of "full time" and "random" sampling studies indicated minimal movement of personnel groups (work crews) from one location to another. Management thought this was a big item originally, however, the studies did not substantiate this. Any movement of small groups of personnel could easily be handled by a centralized transportation department.

The conclusion is that an inordinate number of personnel

are using both pickup trucks and motorcycles during working hours for private transportation around the yard. Approximately 78 motorcycles per hour were observed passing each of the three points along the levee road noted in Exhibit III-2. Also , approximately 37 pickup trucks per hour were noted at positions A and B and 27 pickup trucks per hour at position C.

As noted previously, only a little over 7% of the pickup trucks were carrying what could be considered a skid load of materials. The following data indicate the savings that may be available through the implementation of a shuttle system and the elimination of approximately 50% of the motorcycle fleet and five of the studied number of pickup trucks.

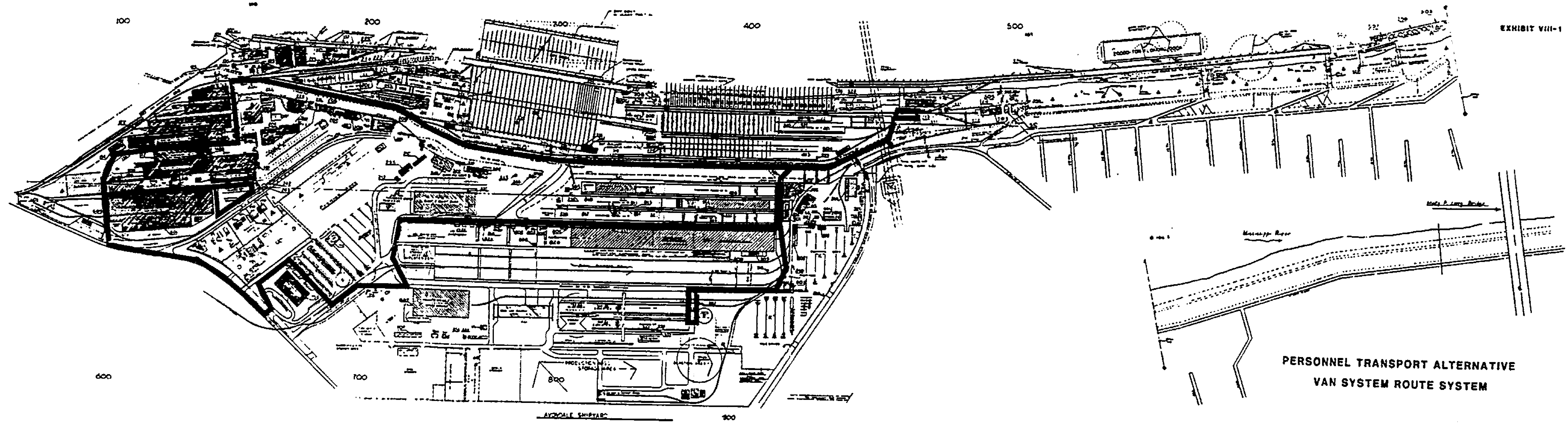
POTENTIAL SAVINGS CALCULATION - IF STUDIED INDEPENDENTLY

Elimination of 174 motorcycles at an estimated annual depreciation of \$267 each	\$46,500
Elimination of 5 pickup trucks at an annual depreciation of \$2120 each*	\$10,600
Reduction average annual maintenance costs on 174 motorcycles at \$215 each	\$37,400
*Reduction in annual maintenance costs on 5 pickup trucks	\$ 7,700
Annual depreciation on 2 vans at \$36,000 5 years	-\$ 7,200
Annual maintenance costs on 2 vans ● =	<u>-\$ 3,170</u>

POTENTIAL ANNUAL SAVINGS IN EQUIPMENT \$91,830

*some of these figures are counted elsewhere as part of the savings attributable to a centralized transportation department.

In addition to savings in equipment, there would undoubtedly be less company time spent on personal business if the shuttle system is installed. This would mean an overall increase in productivity. Since there will be a need for full time van drivers, we have not included the benefits from any labor savings in the calculations.



9. TOWER CRANE ALTERNATIVES

9.1 Potential Savings

During the months of July and August, 1985, a sampling analysis of heavy crane usage was conducted. The cranes located at the building ways and wet docks *were* the object of the study. The study indicates that up to 77.4% of a heavy, Whirley type crane's activities are involved in what can be classified as light lifts. In classifying lifts, the weight of the item was not only considered, but also the shape, bulkiness, and the difficulty of maneuvering it. Heavy capacity cranes are used for light loads most of the time, thereby, potentially delaying heavy lifts and holding up duties for which the heavy cranes were originally designed. The summary of these results were shown previously in Exhibit IV-2.

The use of tower cranes was started at Avondale approximately 15 years ago, Avondale being one of the first yards in the U.S. to do so. A more detailed study is being made by Avondale of the economic benefits of using tower cranes; this study should be complete by June, 1986.

Tower cranes are most suited for light loads when compared to heavy Whirley type cranes. They are capable of stationary freestanding hook heights up to 300 feet. Typical jib end load capacities vary from 6 tons to 23 tons and total (moment) load capacities vary up to 2300 foot tons. (Heavy tower cranes can have even higher capacities.) They are also available in a number of different configurations. There are fixed jib

cranes, climbing cranes luffing boom cranes, articulating jib cranes etc.

Hoisting speeds can vary from a very slow 5 feet per minute in low gear with a 23 ton load to a relatively fast 1250 feet per minute (15 miles per hour) in high gear with a 1-1/2 ton load. However, hoisting speeds are usually in the 80 to 450 feet per minute range. Traveling speeds, if built in a carriage style configuration are very slow. These rated speeds are usually on the order of 60 feet per minute or less than 0.7 miles per hour. Therefore, most tower cranes, especially those with high hook heights, are fixed in place and make extensive use of the rotating tower and moving trolley to position the load. Even typical large tonnage cranes have carriage travel speeds on the order of 1-1/2 times that of tower cranes since their configuration is considerably more stable.

Typical U.S. Naval vessels are under 105 foot in beam width due to the Panama Canal limitations. However, Avondale Shipyards has constructed commercial, tanker type, vessels up to 174 foot in beam width. Tower cranes used to service the typical U.S. Naval vessel could easily be installed with two (2) to four (4) tower type cranes per fixed construction position moving on specially designed high-speed carriages and/or using drop-zone load and unload concepts. Larger beam vessels would need specially constructed tower cranes built directly onto the vessels themselves. The concept of erecting

a tower crane directly onto a reinforced deck of steel is not unusual in the building construction industry. That concept, transferred to ship construction, could have excellent potential for the movement of light loads. This scenario would obviously have to be coordinated with product design engineering to insure the safety of the installation.

Another alternative for tower crane usage (in placid waters only) would be the development of a tower crane barge installation with ramp facilities to a wet-dock. Typical wet docks are equipped with heavy carriage cranes, dockside, for large bulky loads. A barge mounted tower crane, located on the other, water side, of the ship could handle most of the light loading needs of the great majority of the ships undergoing repair and/or conversions. A ramp from the dock would allow small transport vehicles to ride directly onto the crane barge (or better yet, an unattached co-located barge) and be unloaded directly by the tower crane. Avondale presently uses a tower crane mounted on a barge as shown in Exhibit IX-1.

Tower cranes on the dock side or adjacent to the building way positions would normally need to be constructed so as to travel within the lateral movement of the existing heavy cranes. This is especially true on Avondale's wet docks where there is little, if any, room for a tower crane to clear lateral heavy crane movement.

Depending on ship beam, Avondale's upper building ways could lend themselves to the installation of luffing boom type

tower cranes or special "hammer-head" short counter jib type tower cranes that could be installed so as to clear the lateral movement of the heavy Whirley type cranes. These short counter jib cranes generally employ a very heavy counterweight system which is supported with cables and located adjacent to the base of the tower structure. These cranes could be either stationary or carriage type and located inside of the Whirley type cranes.

Fixed position tower cranes could theoretically be reinforced to one another across the beam of the ship. Even traveling tower cranes could conceivably be fixed to one another across the beam of the ship at a high location. See Exhibit IX-2. However, due to safety considerations, it would be difficult to oversee the safe lateral movement of a "tied-together" tower crane unit. It is still conceivable as long as the moves are only of a very short, temporary, nature and after the move the units were braced and guy wired together similar to the fixed position concept. Special limit controls would be required to prevent the load and/or hoisting cables from hitting the tie-in crossmember. Another simpler method, as shown in Exhibit IX-2, would be the tie-in of the tower crane to the ship hull itself as construction progresses.

Avondale - Current Condition:

Light and heavy lifts onto a ship are not the only activities for which the heavy cranes are used. These cranes also service several platens nearby. When taking these lifts

into account, along with idle time, heavy lifts accounted for 21.8% of total-ship lifts and 16.9% of the total crane working time. No matter what measurement is used, it is clear that most of the crane's work is associated with pick-up and delivery of light loads under 5 tons.

Little data exist regarding the cost to Avondale of delays and/or interruptions of work due to the use of heavy cranes for both light and heavy loads. It is known, for example, that Navy spare parts are generally lifted onboard the ship in tri-wall cardboard containers on skids. A ship, such as the SL-7, has spare parts delivered by the truckload to dockside. The SL-7 will probably take over 650 individual lifts if no special hoisting device is used. If it is assumed that a special hoisting device is used that will handle 8 skids at a time, over 80 lifts will be required just for small 4 ft. x 4 ft. skid loads of spare parts. Production requirements may dictate that the heavy cranes be used for other than spare parts lifts at the time of dock delivery. Typically, load/unload crews or work crews are held up and/or need to be rescheduled for other work. Again typically, the heavy lifts will take precedence over light lifts. Invariably, this causes idle time for load/unload crews since they cannot be quickly rescheduled for other work.

In discussions with Avondale personnel, load out crews can vary from 9 to 20 personnel. An average time loss of approximately 2 hours is incurred due to crane unavailability

when load out crews are working. The cranes are typically taken away for seemingly more important heavy lifts. This 2 hours loss multiplies up to 18 to 40 hours loss when the entire load out crew is considered, but since this happens relatively infrequently, this is only a small portion of the problem.

Ship construction crews must be rescheduled on a very frequent basis due to conflicts in lift requirements. It would be safe to estimate that between the platen work and the loading, at least 50 manhours per day are lost due to the unavailability of a crane at each of two building ways. Additionally, it can be estimated that the spares example is typical, and another 18 to 40 hours (say 29 on average) are lost each day due to the unavailability of a crane at one of the wet docks. That brings an estimated total of 79 manhours lost per day on first shift. If it is further taken into account that the yard is only working 60% capacity, this 79 hours translates into 132 hours at full capacity. Also, there are four (4) additional crane operators and hook-up personnel on second shift at the building ways and one Crane operator and one hook-up person at wet dock #3 handling material movements. If it is assumed that 50% of these personnel are required due to scheduling conflicts of the heavy cranes on first shift, that is an additional 250 days x 24 hours delay time due to the lack of light crane availability on first shift.

Extending these estimates into dollars:

Day shift losses:

$$250 \frac{\text{work days}}{\text{year}} \times 132 \text{ hours delay time} = 33,000 \frac{\text{hours delay}}{\text{year}}$$

Second shift losses (50%):

$$250 \frac{\text{work days}}{\text{year}} \times 3 \text{ personnel} \times 8 \text{ hr/person} = 6,000 \frac{\text{hours delay}}{\text{year}}$$

$$\text{TOTAL} = 37,440 \frac{\text{hours delay}}{\text{year}}$$

However, a total of 5 personnel must be added back to operate 5 additional light cranes on day shift at capacity:

$$\begin{aligned} \text{Adjusted potential savings} &= 39,000 \\ &\quad \underline{-10,000} \\ &= 29,000 \text{ hr/yr savings} \end{aligned}$$

$$\$20/\text{hr with fringes} \times 29,000 \text{ hr/yr} = \underline{\$580,000}$$

9.2 Additional Comments on Crane Conflicts

The amount of money to be saved could easily justify the purchase of tower cranes at Avondale. Typical prices for 6 ton tower cranes for light loads run from \$80,000 (used and reconditioned) to \$140,000 for a new self-erecting type similar to Pecco's SMK series. Some other considerations need to be taken into account.

Anytime a crane makes a lift, there may be some conflict with people waiting. However, if working is effectively scheduled by local supervisors waiting should be minimized.

Light lifts can be made early so that the material is waiting for outfitting and construction personnel when needed.

Planning ahead would minimize conflict with present cranes and minimize need for additional tower or equivalent cranes. The lack of tower cranes, however, can severely restrict flexibility. If it is known that there is going to be a long-wait for say 6 hours, heavy lift that will tie-up the Whirley crane(s) , this will happen relatively infrequently, but when it does, serious conflicts will arise -- that 6 hours period is where the real problems occur and where alternative lifting is desirable.

This could justify the need for a tower crane *or* the equivalent. First thoughts are that a deck mounted tower crane, near the center of the radius of the most frequently needed lifts, would make the most sense. Everything else should be handled by the Whirleys, with job rescheduling if necessary.

This would suggest providing one tower crane -- to be deck mounted -- for each major ship repair or construction project. Avondale would avoid:

- dockside conflicts on wet docks with Whirleys and with movable tower cranes

- having to find clear locations from the Whirleys to set up towers alongside ships on the building ways

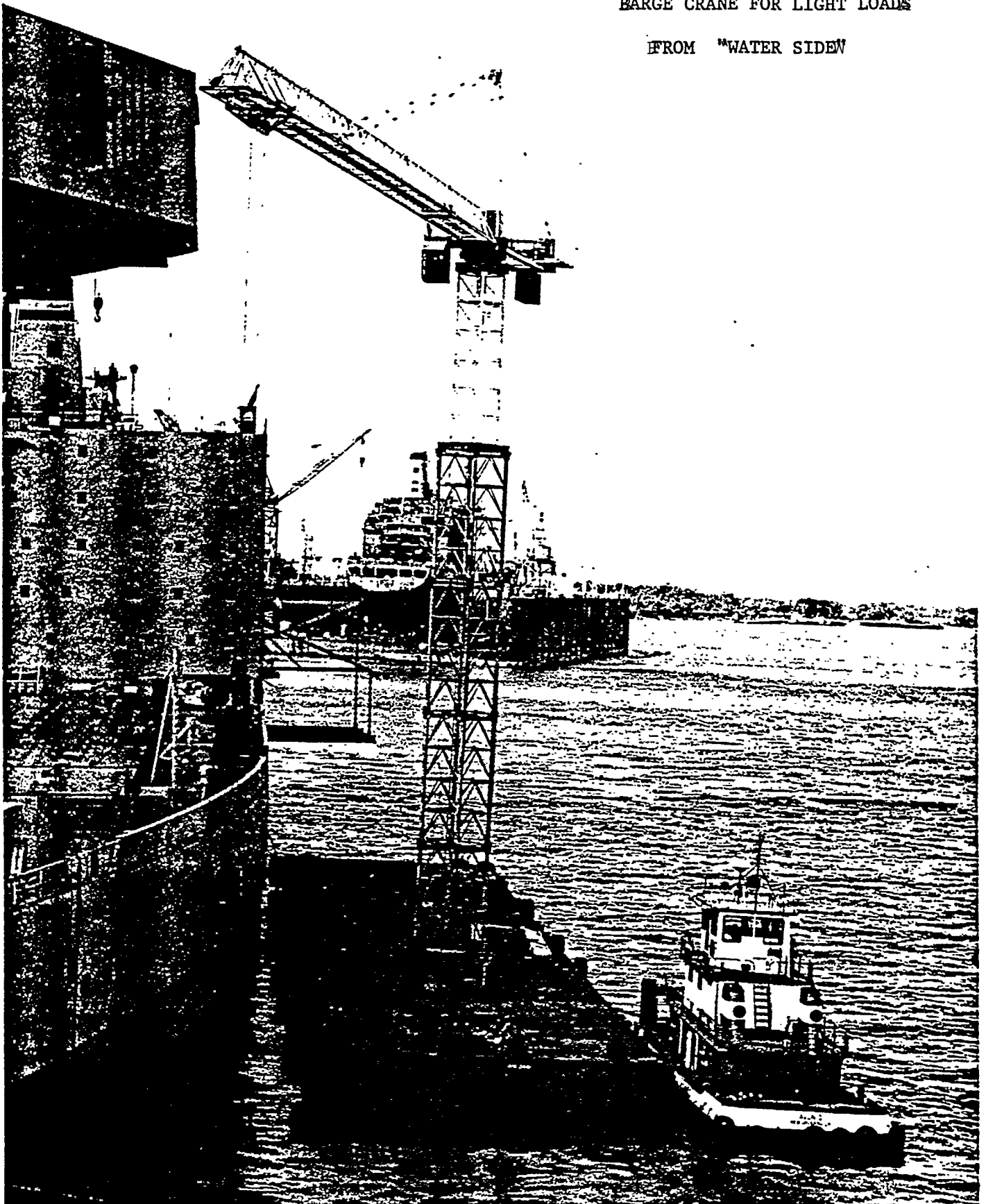
- having to provide a large mounted tower crane for waterside work

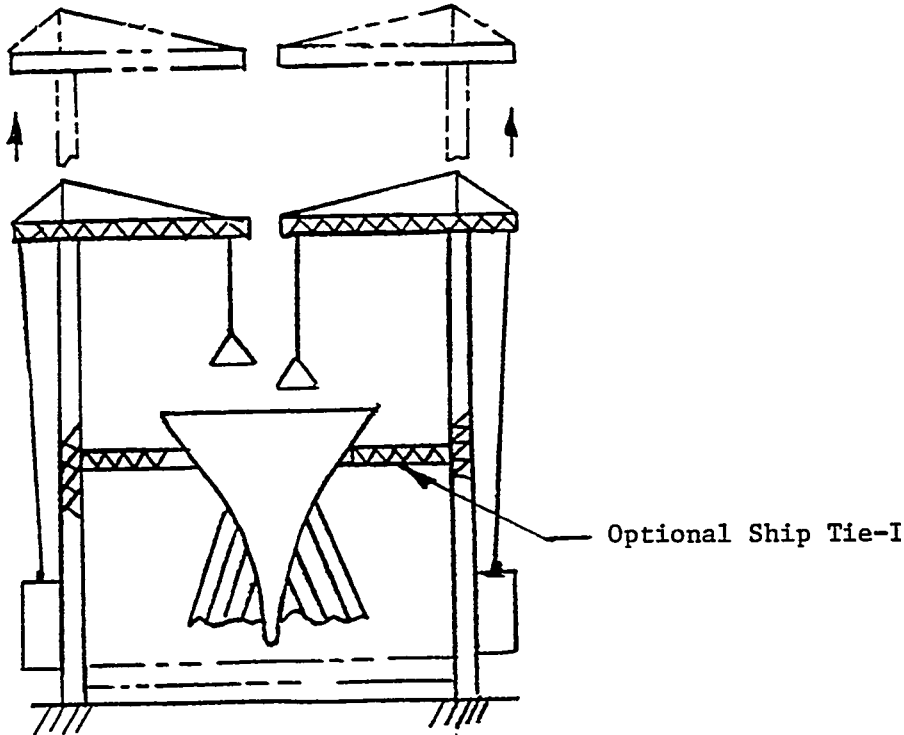
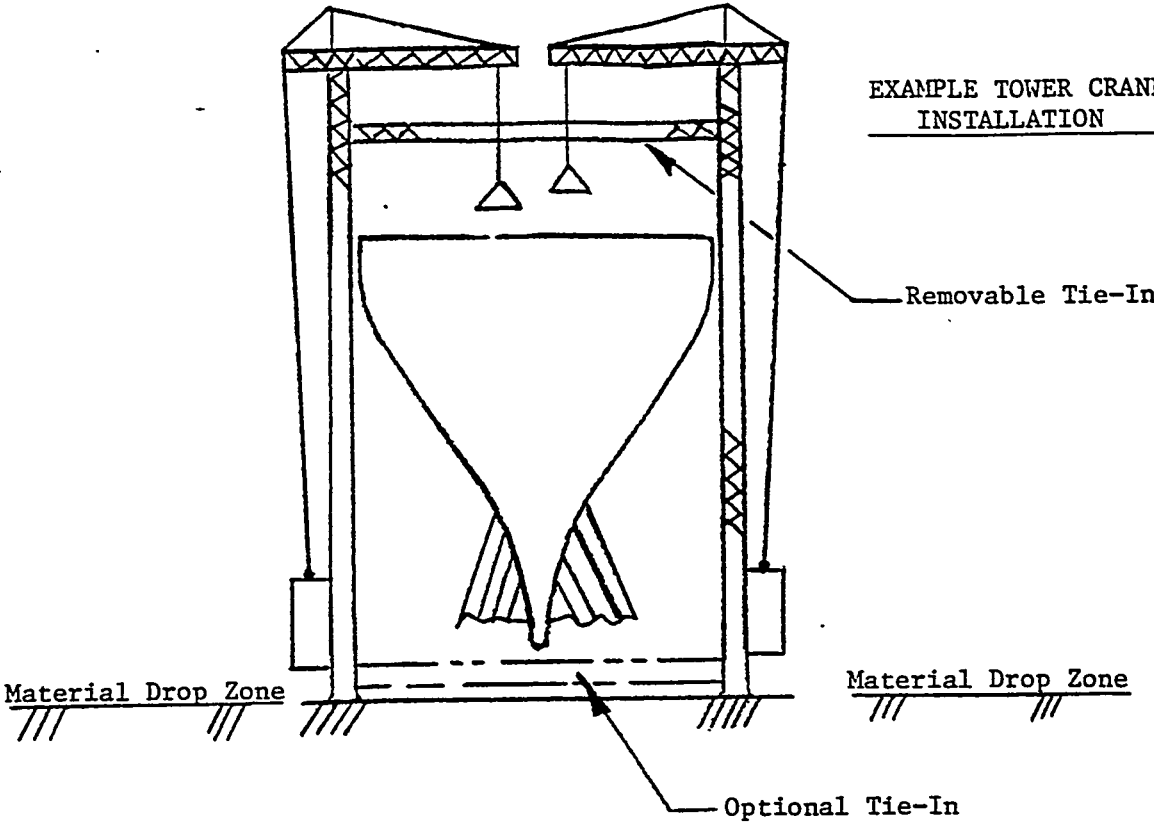
It is recommended that Avondale purchase one (1) 6 -ton capacity tower crane (preferably deck mounted) for the next big project, either wet dock repair, outfitting, or building ways. This should prove out the benefits of a tower crane installation.

With new, heavy lift cranes, approaching and/or exceeding \$3,000,000 in cost, tower cranes should definitely be considered as a very viable alternative.

BARGE CRANE FOR LIGHT LOADS

FROM "WATER SIDE"





10. OTHER VERTICAL TRANSPORTATION CONSIDERATIONS

10.1 Personnel Hoists (Elevators)

In shipbuilding, getting workers to and from their jobs can be a time consuming activity that does not contribute to production. Due to the involvement of vertical heights, a critical factor, time wise, is getting people on and off a ship.

Getting shipbuilders to their work places is comparable to getting miners to and from their work sites in underground mining of coal or minerals. The accepted method for transporting workers below ground in mining operations is by elevators traveling vertically. Although in shipbuilding vertical distances are much shorter, the same method can be used very successfully.

The results obtained by employing elevators in ship construction are particularly effective. Unlike the mining industry, in shipbuilding the concentration of people at the start and end of a shift is often exceeded by the on and off activity of people that is going on continuously throughout the workday. Elevator usage at Avondale is very effective and was covered in detail in Section 4.3.

10.2 Manlifts

During the course of our study, we considered the use of vertical manlifts as illustrated in Exhibit X-1. For those readers of this report that are unfamiliar with manlifts, the following information may be helpful.

Manlifts are essentially continuously moving vertical

conveyor belts with facilities for personnel to step on and rise to great vertical heights. Belt speeds have been slowed to approximately 75 feet per minute in recent years, however, they have been known to be much faster in years past. Manlifts are much cheaper than elevators. Also, there usually is only an average of approximately 8 seconds or less waiting time at 75 feet per minute speeds and twenty feet between step-on platforms. At ten foot spacings of platforms there is only a 4 second or less waiting time.

Manlifts have been used for many year-s in high rise facilities such as breweries, grain elevators, parking garages, process industries, etc. , where vertical transportation is important. According to one supplier, manlifts are also currently being used at San Francisco Bay Naval Shipyards, Mare Island Site, Vallejo, California. Most manlift manufacturers claim that they meet all OSHA and ANSI safety standards, although, individual State requirements may be highly variable.

One of the negative aspects of using manlifts is that absolutely nothing can be carried by the person using the device. In other words, a person using the lift could not carry a small piece of pipe in one hand and hold the handrail with the other hand while traveling.

Also, since safety of workers is of a major concern, it is felt that a housing structure would need to be installed completely around the manlift with artificial floors and safety

hoods installed at various intervals. This would insure that any accidental fall would be limited to a small height. This is perhaps the greatest weakness of a manlift. A dishonest worker could easily fake a fall and an injury when using the manlift. Whereas elevator safety is more dependent upon mechanical design and construction, a manlift's safety is more dependent upon the individual users. For this reason, the use of a manlift is NOT recommended at Avondale.

10.3 Material Hoists

Although cranes are used to put almost all materials onto a ship under construction, elevators can be used if necessary for light materials. An elevator could be designated for loading light materials instead of using a heavy crane. Also, workers who would be reluctant to carry materials up stairways do so without thinking about it when they are using an elevator.

Avondale's current practice is to use elevators (or hoists) for personnel only. In this regard, the outboard doors of the cabs have been welded shut so that the cabs can only be loaded and unloaded on the ship side. This practice appears to be unique to Avondale. At least one other shipyard visited during the course of the study uses both sides of their elevator(s) for loading and unloading. Apparently, this is an extra safety precaution taken by Avondale.

Although an elevator type material hoist could be installed for very light, hand movable loads at Avondale, it is felt that any investment in this regard should be directed

towards tower cranes. Tower cranes have a great advantage over elevators in that material can be located much more closely to the final point-of-use. Whereas elevators move in one direction only - vertically, tower cranes move in that direction along with rotation and horizontal movement of the trolley along the length of its extended jib. Tower cranes offer much more flexibility with regard to final material positioning.

10.4 Escalators/Moving Belts

As a part of the overall study, moving escalators were also considered for getting personnel aboard ships. Theoretically, escalators would be best suited for those dock installations where there would be little change in lift height required. Most escalator installations are relatively inflexible with respect to length once they are fabricated.

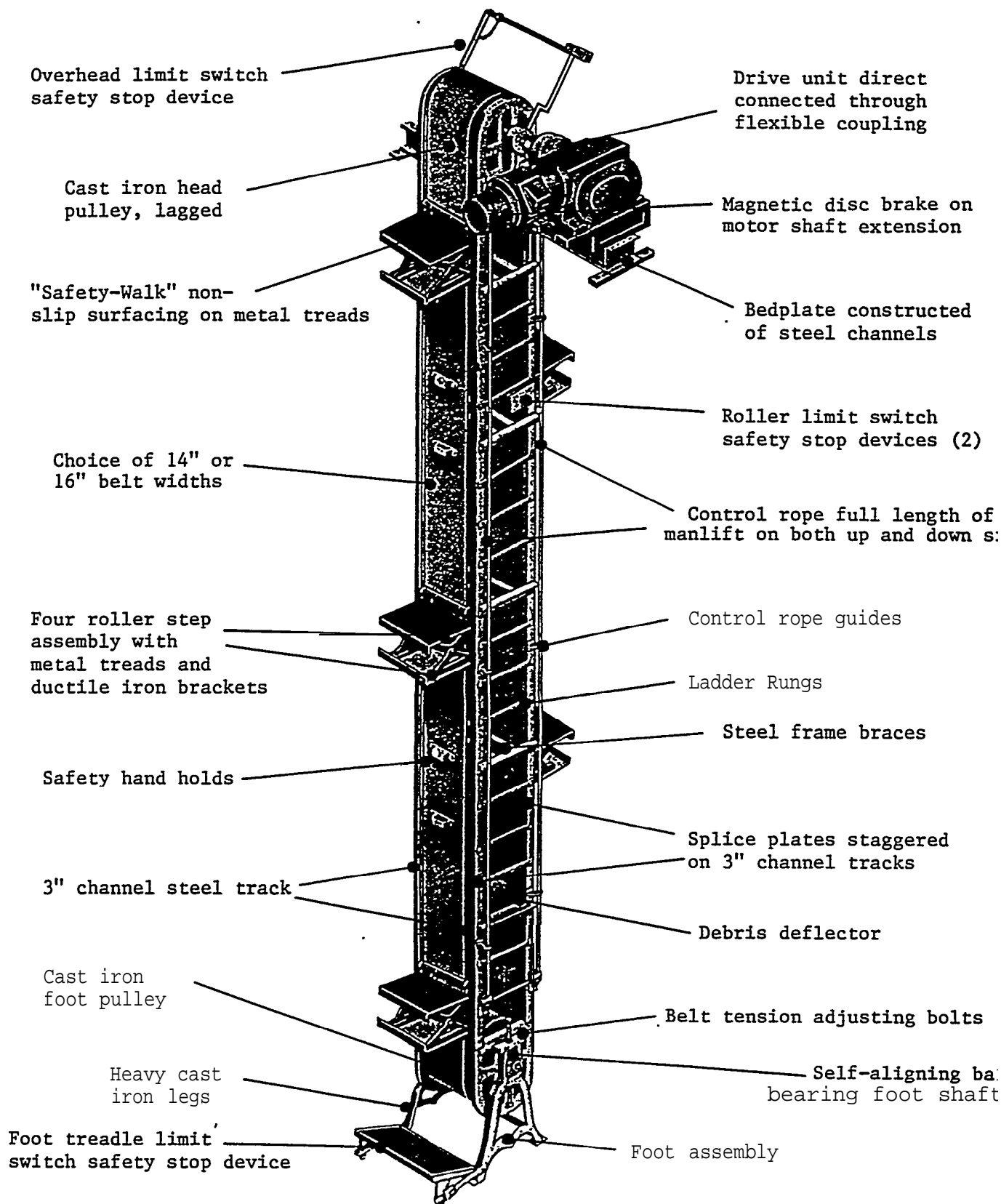
The biggest negative factors with regard to escalators versus elevators are: a) initial cost, and b) ongoing maintenance. Due in part to the number of used outdoor construction type elevators available, their initial cost is relatively low -- on the order of \$20K to \$30K per 20 feet rise. Even new elevators can be purchased for approximately \$40K for a 20 feet rise. Outdoor elevator costs can therefore be estimated at roughly \$1,000 to \$2,000 per foot of rise.

Escalators on the other hand are much more expensive. It is estimated that an outdoor escalator installation would cost on the order of \$100,000 for a 20 feet rise. Also, escalators

are much more suited for relatively clean, indoor environments and their maintenance costs in an outdoor, shipyard environment, would be much higher than an elevator installation.

Similarly, continuously moving belt installations, such as those installed at the San Diego Zoo, are not as portable as elevators, although they can be moved. The major problem with moving belts are the very long lengths required due to the need for a small pitch rise. Due to that length and the relatively slow belt speeds, moving belts are no match for elevator installations. They would have a beneficial effect with regard to fatigue and they would eliminate waiting times, but the slow speed of rise would definitely favor the elevator in a shipyard environment.

"EXAMPLE OF A MANLIFT"



11. STATE-OF-THE-ART / SHIP CONSTRUCTION/REPAIR

11.1 Other U.S. Based Shipyards

As part of this project, a number of tours of other U.S. shipyards were undertaken. Those locations visited were:

- a. NASSCO, San Diego, California
- b. Peterson Builders, Inc., Sturgeon Bay, Wisconsin
- c. Todd Pacific Shipyard, San Pedro, California
- d. NORSHIPCO, Norfolk, Virginia

NASSCO'S work was the nearest to Avondale's main yard work compared to the other three yards. The Peterson yard is somewhat smaller than Avondale and specializes in new construction of vessels typically in the 1000 to 2000 ton range. Todd Pacific specializes in vessels of the medium size Navy Frigate style but has the capability for building vessels of larger size. NORSHIPCO is a relatively large yard specializing in vessel repair work and has the capacity and capabilities to work on a wide variety of ship sizes.

11.2 State-of-the-Art Comments - General

There are only minor differences in the way the various yards handle light loads and personnel movements. Most of the differences can be attributed, principally, to the differences in yard layouts and the type of work done.

As one "type of work" example, NORSHIPCO uses an elevator to transfer personnel from dock level to the top of the wing wall on their large dry dock. Avondale normally does not use a fixed elevator on the wing wall of the dry dock. However,

since NORSHIPCO specializes in repair and reconditioning of vessels, a large number of their workers must be transferred to the upper deck of the ships (gangway from the wing wall). Avondale does not need to transfer that many personnel in the large dry dock position since their work at this position is principally on the outside of lower hulls. Avondale does use elevators on their construction building ways.

As another example illustrating differences due to "type of work" and "yard layout", Peterson Builders make extensive use of large crawler type mobile cranes instead of large Whirley or tower cranes. These are extremely useful in their particular environment where yard and ship lengths and beams are of relatively short dimensions.

Most of the yards depend heavily on fork lift trucks and wooden pallets in the 3-1/2 to 4 feet square range. Where yards are spread out, heavy reliance is placed on stake body type trucks of approximately three to five ton capacity with single axles.

Due mainly to yard layout, NASSCO makes very good use of mule train type material handling vehicles. These appear to be ideally suited to yards such as NASSCO and Avondale, although the cost of mule train equipment is higher at Avondale because of the need for fitting brakes to handle operating on the levee grades. NORSHIPCO also uses the mule train type system to some degree. NORSHIPCO makes very good use of a personnel shuttle

bus system in their main yard. They also make excellent use of bicycles for yard transportation even though their yard is not paved.

Some shipyards use zone methods of equipment control. Some have centralized transportation departments - others have a mixture of centralized and decentralized schemes. All of these are designed around the layout problems associated with each particular yard.

Both Avondale and Peterson have made good use of space in their main warehouses through the use of high bay racking and narrow aisle lift equipment.

Every shipyard could use better organization and/or equipment in their outside yard storage areas. Most shipyards have expanded in a piece-meal fashion over a great many years. Due to these previous adhoc expansions with no overall master plan (in most cases), most shipyards pay a penalty in material handling costs due to layout and/or location of major operations.

Every yard experiences similar problems with material handling within ships. Avondale's problems in this area have been reduced enormously with the advent of zone or large unit outfitting prior to ship installation with the process lanes method. For those items that still must be installed within the ships after main construction, manhandling and chain pulls are still the methods used for handling relatively heavy loads

below decks. The reasons for this are usually the same there are a number of obstacles and variations within confined areas such as engine rooms, etc., that prevent the use of standard type of handling equipment. As mentioned elsewhere in this report, the key to handling materials in confined areas within new ships lies in the original engineering **design**. Maritime engineers and ship designers need to be convinced that built in material handling aids will actually reduce the cost of ship construction and major overhaul and repair work in the long run.

11.3 Cable Cranes

Another conceptual alternative for handling light loads in a shipyard such as Avondale would be the use of a cable crane of the type used in dam construction.

Exhibit XI-1 shows a Japanese manufactured cable crane which can handle up to 9.5 ton loads across a span of over 900 feet. The following is a translation of the specifications shown in Exhibit XI-1:

CABLE CRANE		
Span	296.5m	973 ft.
Lift	115m	377 ft.
Load	9.5 ton	9.5 ton
"Bucket" volume	3 cu.m	106 cubic ft.

Winding speeds:

Up with load	9 0m/min	295 ft/min
Up without load	150m/min	525 ft/min
Down speed	130m/min	427 ft/min
Horizontal span speed	300m/min	984 ft/min
Traverse speed	12m/min	39 ft/min
Fine adjusting speed	1.3m/min	4 ft/min

The particular cable crane shown in the exhibit is manufactured by the Japanese firm Ishikawasima - Harmima Heavy Industries, although it is believed that similar cable cranes can be found within the United States.

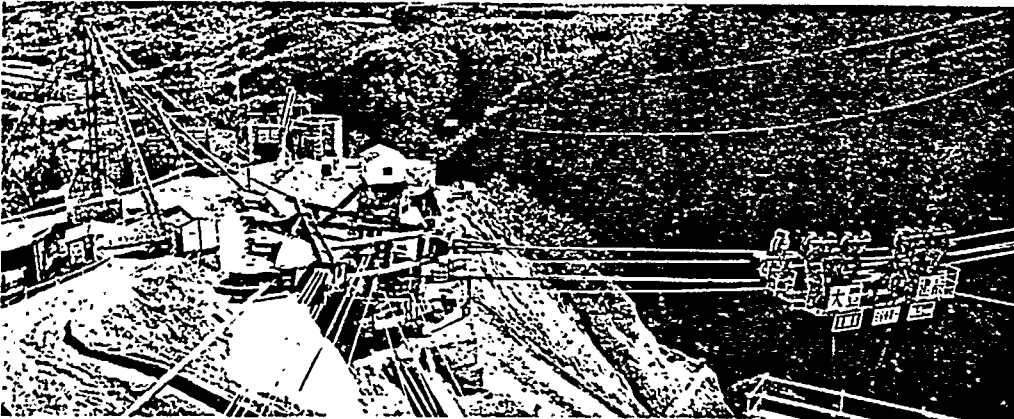
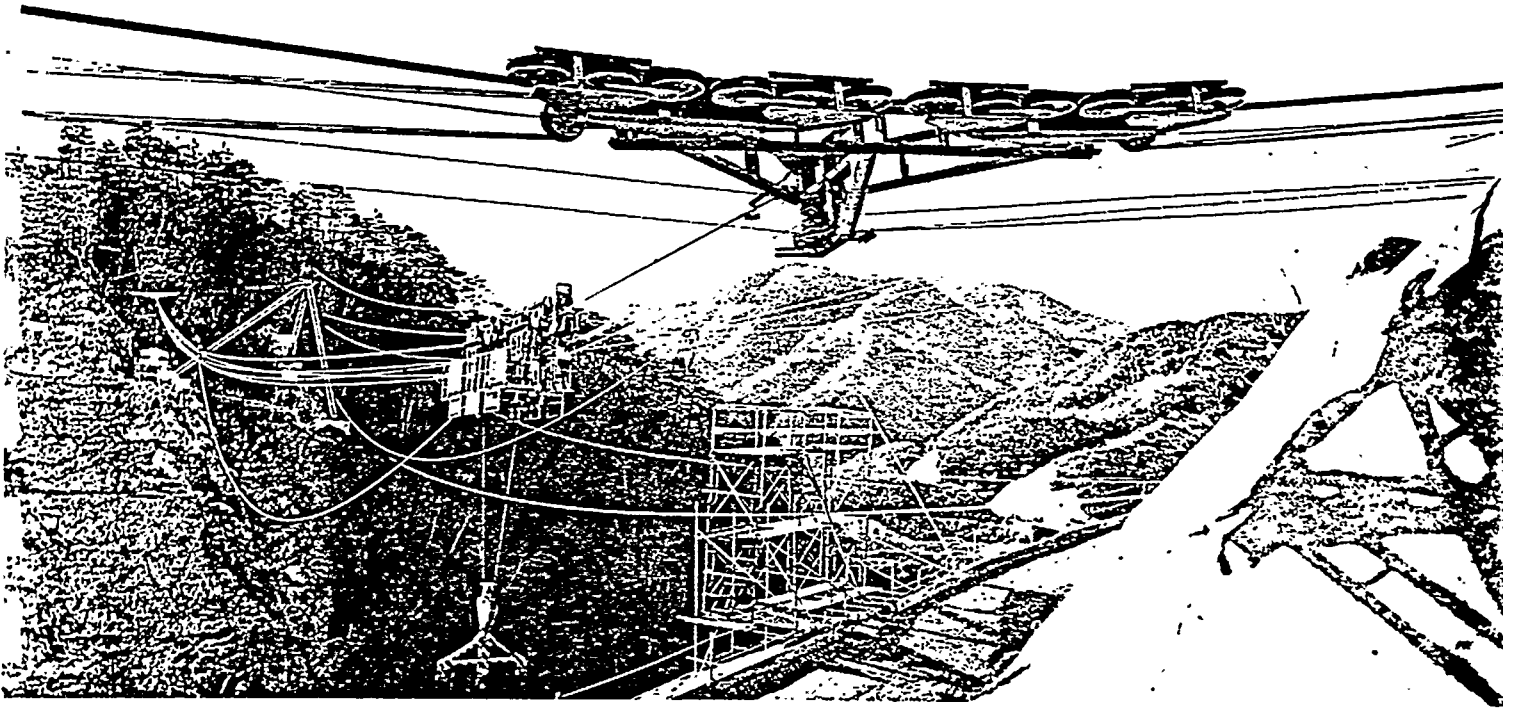
The concept is that this type of cable crane could be installed over each of the building ways. If towers were constructed for the support points, the cable equipment could ride over and above all of the other crane structures within the yard.

Avondale has previously studied the possible use of cable cranes, and no doubt will again in the future. One prime factor which must always be considered with these units is safety during installation.

Since this would be such a radical change to the way the shipyard is currently operating, no detailed cost estimates have been developed for this type of system. However, it is believed that an installation of this type would be cheaper and offer more flexibility than a fixed overhead bridge crane type

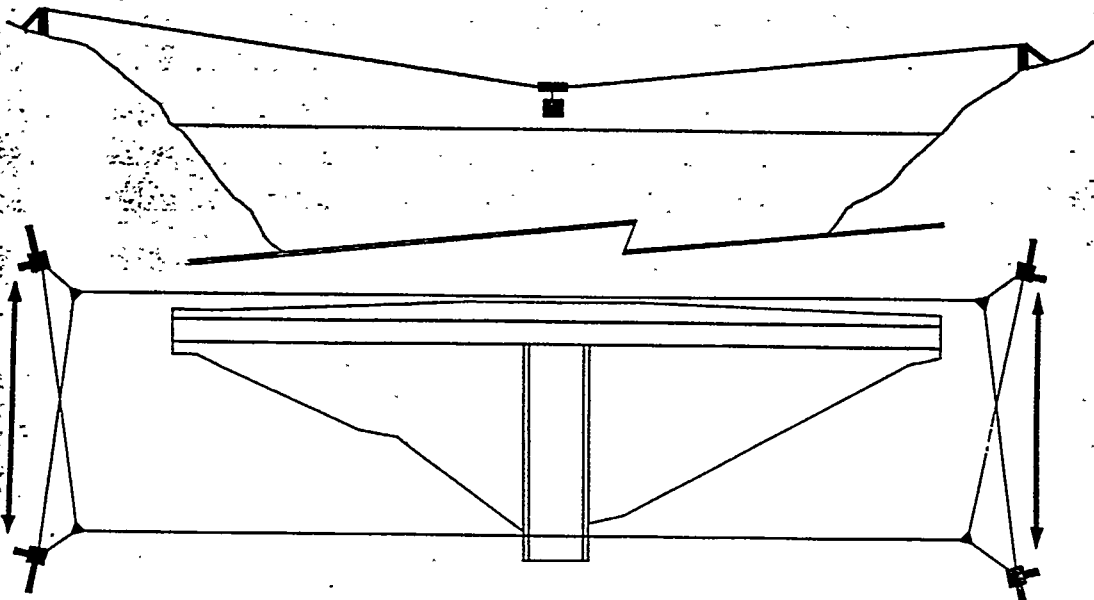
installation. On the other hand, this type of system would probably be much more expensive than a few tower crane installations. Nevertheless, a further study of this concept could be warranted.

LONG SPAN CABLE CRANE



9.5t 横川ダム向

スパン	296.5m
リフト	115m
吊り荷重	9.5t
バケット容量	3 m ³
巻上(実)	90m/min
巻上(空)	160m/min
巻下	130m/min
横行	300m/min
走行	12m/min
主索調整	1.3m/min



12. A CENTRALIZED TRANSPORTATION SYSTEM PROPOSAL

12.1 Background

As evidenced in the main body of this report, an in-depth study on moving light materials and personnel at Avondale Shipyard was conducted during the period June through October, 1985. The study excluded all Maintenance vehicles and non-production/warehouse vehicles. A considerable amount of raw data was accumulated and analyzed. Both internal people and outside consultant help were used during both the data collection and analysis phases. The data collected were discussed with management personnel during several review meetings.

12.2 Charter of New Department

The centralized transportation department should be set up within the material control/planning function. This department should report directly to the vice presidential level and should coordinate the transportation of all materials (and personnel) within the yard. The function would act as the intermediary between the storage operations and all production operations. The new transportation department would have the following responsibilities:

- a. The "real time" movement of all materials within the yard taking into account both the master production schedule and the specific daily needs of production.
- b. Responsible for assigning the proper vehicle and rated driver for the specific load to be moved, taking into account load weight, shape and/or bulk.

- c. Coordination with the storage areas and production areas with regard to proper notice and staging of materials to be moved. For example, the warehousing and outside storage areas would have a staging area, set up for the weekly master schedule "bucket", or a portion thereof, of materials to be issued to production. The production departments would issue written or verbal requests to the transportation department requesting the following workday's materials needs.

Copies of these requests would also go to the warehousing/storage area. This will keep the large weekly staging areas for materials where they rightfully belong - in warehousing/storage where the materials reside in the first place. Also, the only materials issued to production would be those which are for a maximum of, say, two days worth of work and more importantly, would only be the materials needed. A large portion of the double handling of materials would be eliminated.

- d. The new function would have overall responsibility for all of the following transportation equipment and any new transportation equipment purchased by Avondale.

pickup trucks

flat bed trucks (stake bodies)

flat bed trailers

all fork lift trucks
-cherry pickers
special transporters (including the Kalmar)
yard jockeys
yard tractors
mule train and tractor
side loaders, front end loaders, etc.
gondolas and other r.r. cars and locomotives

- e. The transportation department would be responsible for all personnel, drivers, etc., associated with the above equipment except where the equipment is assigned to a particular superintendent such as with the present zoned fork lift truck system.
- f. Transport equipment would still be maintained by the maintenance department. However, the transportation department would be responsible for analyzing purchase/lease costs, maintenance down time and cost history of all the equipment under its control. The department will be responsible for maximizing equipment utility and minimizing departmental costs.
- g. Each piece of equipment would have a log maintained on service problems, etc. In addition, drivers will be held responsible for maintaining a "squawk sheet" or turnover sheet so that the next driver will be forewarned of any vehicle defects before starting the vehicle.

- h. Vehicles would be dispatched from a central control office and/or particular zone areas and would be returned to these dispatch areas at the end of each shift.
- i. The transportation department would be **responsible** for the return of all empty containers (skids, pipe baskets, etc.) to the original points of issue.

12.3 Estimated Savings

Implementation of the proposed transportation department should reduce the 88 vehicles studied to 50 active vehicles. 38 vehicles can be retired and/or sold. See Exhibit XII-1 for details.

When this recommendation has been implemented, Avondale can expect to achieve overall estimated savings in excess of \$325,000 per year, excluding intangible benefits.

The direct cost to set up the proposed centralized transportation department is estimated at \$3,500 to \$4,500.

The \$325,000 plus annual cost savings estimate is conservative. No estimates have been included for cost savings at the individual work centers due to better coordination of loading and unloading.

The need for discipline must be stressed in controlling the number of pickup trucks and their centralization. It is relatively easy for management to allow a particular superintendent or function to have their own pickup truck. It is somewhat more difficult to remove that truck once a precedent has been established.

Manning estimates for the new department are also considered to be conservative. The following initial needs have been estimated:

- a. manager
- b. clerk/typist
- c. dispatchers
- d. truck and tractor trailer drivers

Most of these personnel are already working at the shipyard or will be displaced as a result of centralization. Fork truck drivers, etc., have not been shown, "although some of those would be included in the new department. See the organization chart in Exhibit XII-2.

12.4 Implementation Schedule

Phase I October, 1985

Phase II December, 1985

Phase III Sustaining effort

12.5 Phase I

12.5.1 Site Selection

A suggested site location is shown in Exhibit XII-3. This could be utilized for Phase I of this project. A proposed layout for the area is shown in Exhibit XII-4.

12.5.2 Facility Layout

A space layout of the area will need to be prepared. Approximately forty-four (44) trucks and nine (9) tractors will be parked in this area initially. Fifteen (15) of the trucks will be selected for liquidation and moved to a temporary storage site. The Phase I parking should be of a

size to accommodate parking twenty-nine (29) trucks and nine (9) trailers.

The thirty-eight 38 trailers will originally be zone located around the shipyard utilizing Avondale's existing system. It is suggested that a 12 ft. x 60 ft. movable (leased trailer) dispatching office be installed on the site selected. Phase III of this project could develop and suggest a site change through logistics and efficiency. Also, Phase III would include the implementation of the other recommendations within this report.

12.5.3 Site Preparation and Facility Installation

Install the trailer and appropriate utilities.

Install the communication system using existing equipment and dispatch phone numbers.

Provide and install the appropriate office furniture and office supplies using existing items.

Layout parking area showing parking slots for each vehicle.

12.5.4 Department Personnel Selection and Manning

With the general organization chart for the transportation department shown in Exhibit XII-2, Phase I manning requires no new hires. The personnel can be selected from the existing Avondale work force. Phase I manning is as follows:

Transportation Department

- a. Superintendent
- b. General Foreman
- c. Clerk

d. Dispatcher Number (2) (Existing, responsible for pickup and stake body trucks.)

12.5.5 Night Shift

Some provisions will need to be made for second shift dispatching. One existing night shift truck driver (or one under-utilized day shift driver) will have to be trained as a dispatcher for second shift. The transportation system used for night shift, however, could remain the way it is today with no ill effects. Third shift would not be manned by the dispatch office. That would be handled by arrangement between the transportation superintendent and the requesters' superintendents.

12.5.6 Transportation Equipment Transfer

Schedule the equipment for turnover one weekend. All pickup trucks, stake body trucks, truck tractors, and yard jockeys would be delivered to the new central location at the end of the shift on Friday. The radio equipment located in the dispatch area of warehouse #1 would be relocated over the weekend to the new location.

The maintenance department will have previously investigated their records and will have ranked those trucks that should be slated for temporary storage. This list will be reviewed by the superintendent and general foreman of the new department. Ten (10) pickup trucks and five (5) stake body trucks will be selected for "retirement." These trucks will physically be moved, over the weekend, to an allocated storage

area in the Harvey yard. It is presumed that all radios, if installed, will be removed and remain at the main yard.

12.5.7 Activate Phase I of the Transportation Department

Phase I, as proposed, could be implemented within three weeks of an approval to go ahead, which could be scheduled for as early as October, 1985. The cost to implement is estimated at \$3,500 to \$4,500. This would be to provide the facility. Cost reduction is estimated at \$65,040 by retiring fifteen (15) vehicles immediately. See Exhibit XII-5 for cost reduction estimates for Phase I.

12.6 Phase II

12.6.1 Department Personnel Selection and Manning

Phase II manning requires no new hires. The personnel can be selected from the existing Avondale work force. Phase II manning is as follows:

Transportation Department

- a. Dispatcher number (1)
- b. Dispatcher number (3)

Operating Procedure: Although the manager of the new department will have the authority to determine his/her own procedures, the following could be a "start" for the department.

Dispatcher number (1) will be responsible for the following vehicles:

lift trucks	mule train
cherry pickers	crawler cranes
special transporters	30,000 lb. Kalmar

Dispatcher number (3) will be responsible for the following vehicles:

over the road trailers gondolas
railroad cars locomotive cranes
miscellaneous vehicles as directed

The responsibilities of dispatchers (1) and (3) have been previously outlined. Existing procedures will remain in effect, particularly the lift truck system. The overall management authority will be transferred to the superintendent of the transportation department. Equipment assigned to a particular superintendent such as the existing zoned lift truck system will remain as is.

Transportation equipment transfer: Equipment assigned to dispatcher (1) and (3) will take place at the end of the shift Friday on the implementation date of Phase II.

The superintendent of the transportation department will designate zone parking of all vehicles under his jurisdiction prior to the implementation date and duly instruct his general foreman.

12.6.2 Activate Phase II of the Transportation Department

Phase II, as proposed, could be implemented with minimum disruption as early as December, 1985.

The estimated cost to implement Phase II is intangible. No facility cost is required. The only cost incurred would be reassignment of personnel with minimal disruption.

The decision to reduce the transportation fleet by 23 more vehicles could be made after the activation. of phase I utilizing 30 to 45 days experience.

Phase I and II, combined, will reduce the transportation fleet by 38 vehicles, which is a conservative reduction. The combined savings shown in Exhibit XII-5 are estimated at over \$325,000 per year.

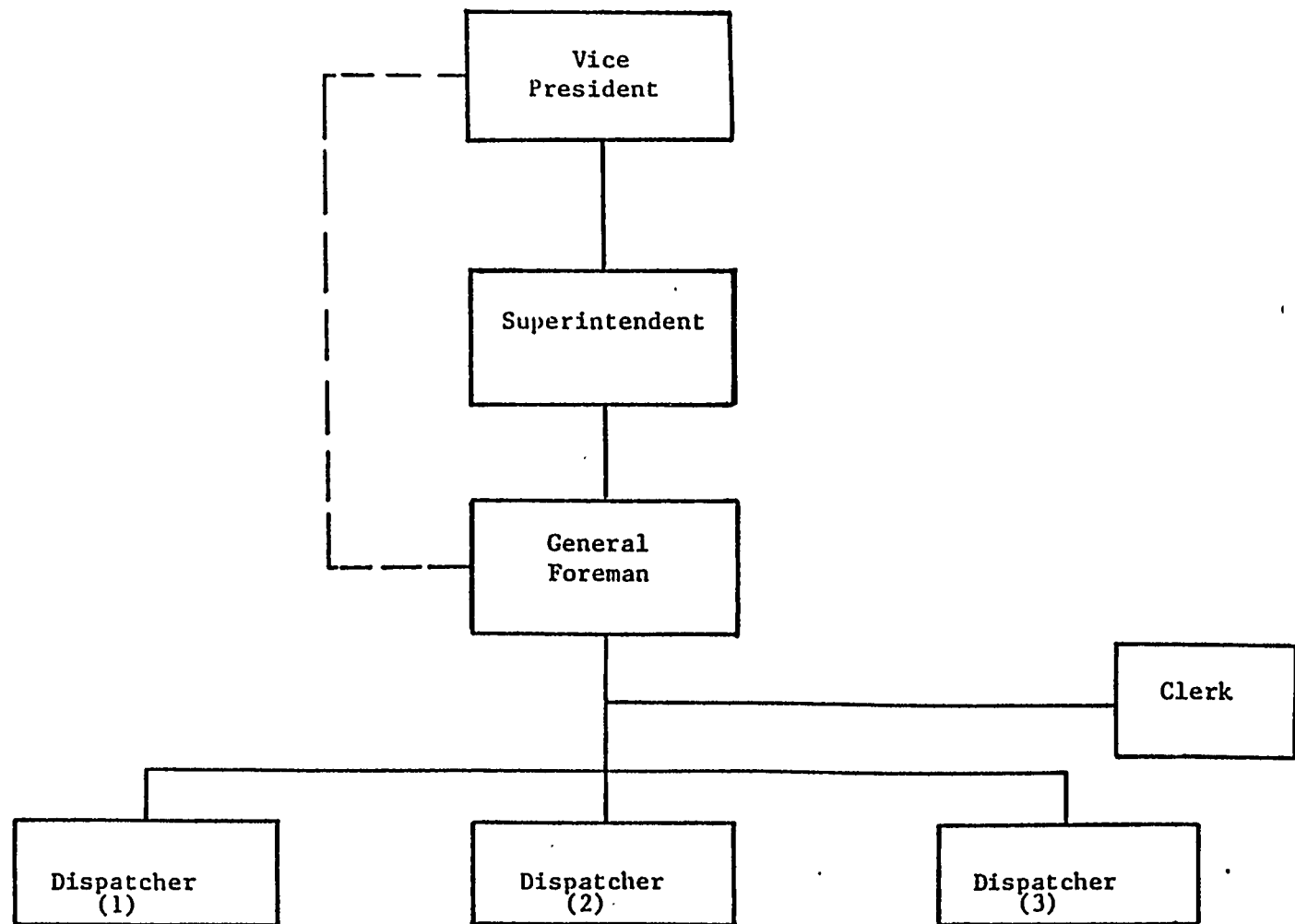
EXHIBIT XII-1

CENTRALIZED TRANSPORTATION SYSTEM
ANNUAL COST SAVINGS (ESTIMATE)"

	<u>PICKUP TRUCKS</u>	<u>STAKE BODY TRUCKS</u>	<u>TRAILERS</u>
Quantity (existing)	27	23	38
Quantity (proposed)	7	13	30
Drivers (existing)	(assume)	(assume)	
	13	13	9
Drivers (proposed)	7	13	7
Reduction in Drivers	6	—	2
Annual Labor Savings at \$30,000 w/fringe	\$180,000	- -	\$60,000
Equipment Reduction	20	10	8
*Estimated Replacement Cost each			
Pickup truck	\$10,600		
Stake body tk-	\$17,250		
Trailer	-\$12,750		
Depreciation Reduction 5-year life	\$42,400	\$34,500	\$20,400
Pickup truck	-\$2,120		
Stake body tk-	\$3,450		
Trailer	-\$2,550		
Maintenance Reduction	\$29,100	\$16,080	\$11,946
Savings - SUBTOTAL	<u>\$251,500</u>	<u>\$50,580</u>	<u>\$92,346</u>
			GROSS TOTAL \$394,426
Add back 2 additional personnel to staff department:			<u>\$60,000</u>
NET ANNUAL SAVINGS			\$ 3 3 4 , 4 2 6

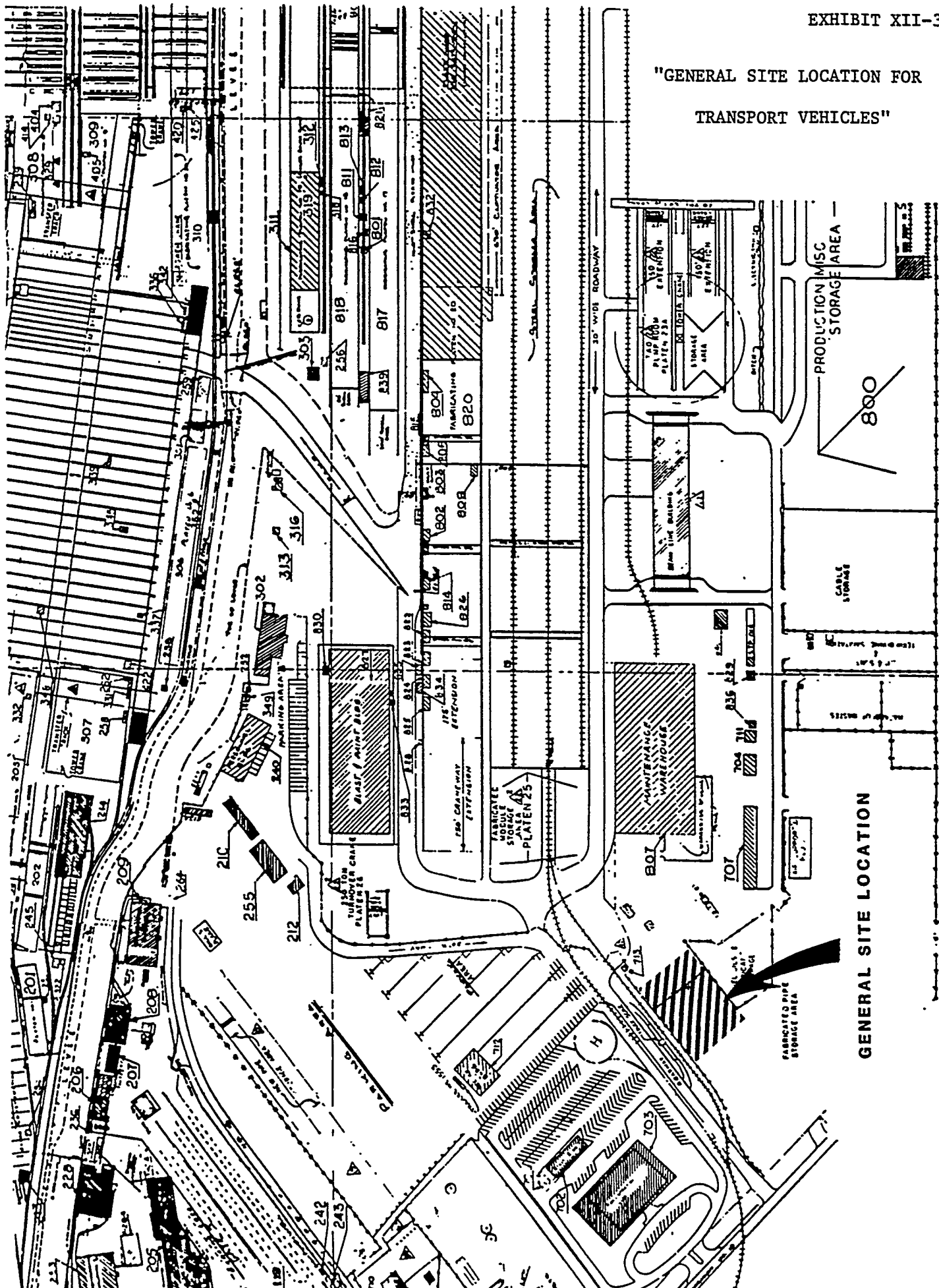
*Does not include radio equipment

NOTE: All vehicles included in the Maintenance Department were excluded from this study.



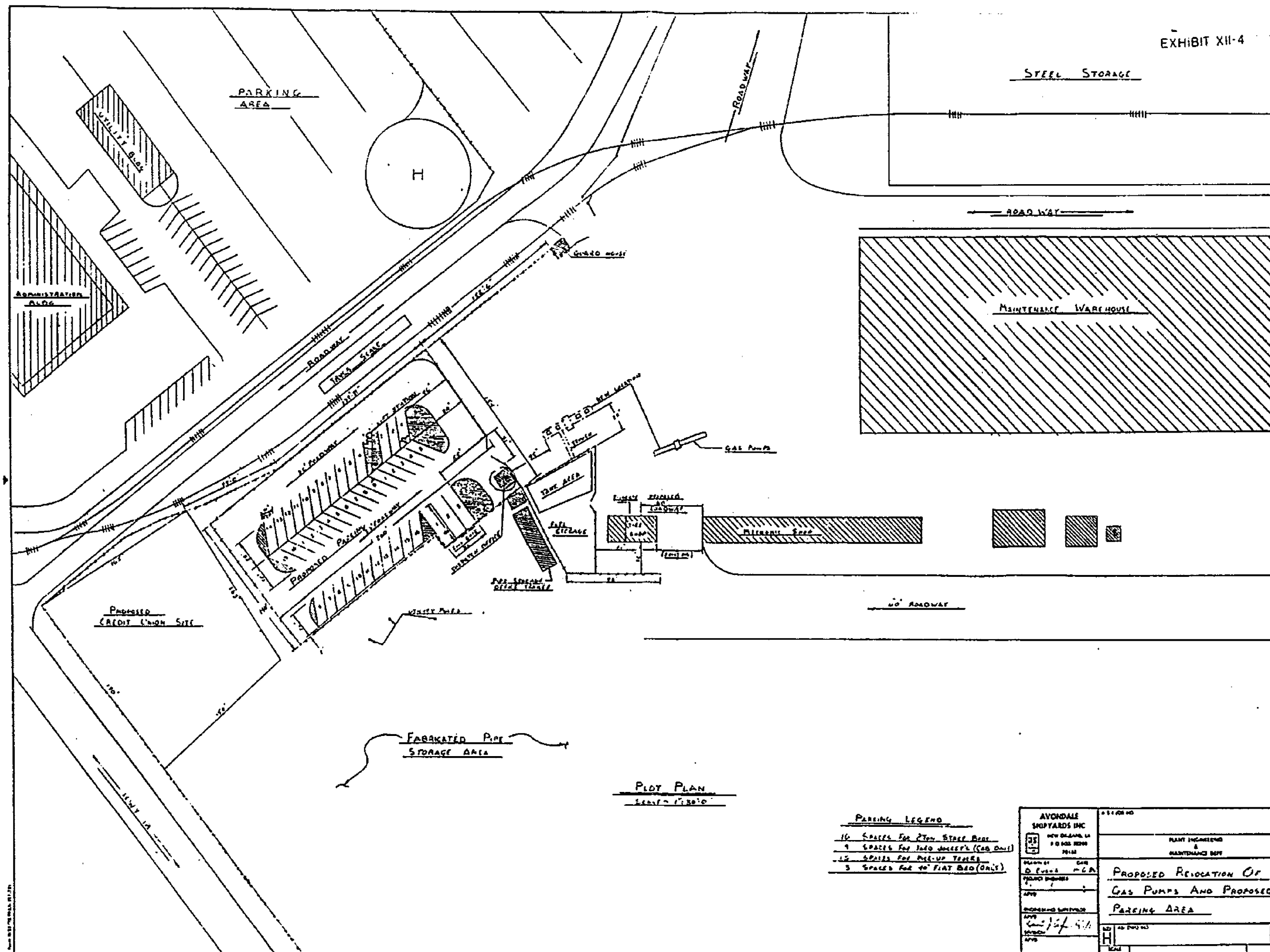
ORGANIZATION CHART
CENTRALIZED TRANSPORTATION SYSTEM

"GENERAL SITE LOCATION FOR
TRANSPORT VEHICLES"



AVONDALE F SHIPYARD

GENERAL SITE LOCATION



PAULING LEGEND

- 16 SPACES FOR 2TON STAFF BARS
9 SPACES FOR INTO JACKETS (CAR ONLY)
15 SPACES FOR PICK-UP TRUCKS
3 SPACES FOR TO FIAT BEO (ONLY)

AVONDALE SHOPTARDS INC NEW ORLEANS, LA P O BOX 8090 70161		A S E FOR AND PLANT ENGINEERING & MAINTENANCE DEPT	
PROJECT NO <u>0-100-1</u> - C.A. PROJECT ADDRESS <u>1</u> CITY <u>NEW ORLEANS</u> ENGINEERING SURVEYOR DATE <u>12/1/71</u> SURVEYOR <u>[Signature]</u>		<u>PROPOSED RELOCATION OF</u> <u>GAS PUMPS AND PROPOSED</u> <u>PARKING AREA</u>	
ADJ H AS THIS WAS SCALE			

ANNUAL COST SAVINGS ESTIMATES

<u>*VEHICLES</u>	<u>EXISTING</u>	<u>PEASE I</u>	<u>PHASE II</u>
Stake Body Trucks	23	18	13
Pickup Trucks	27	17	7
Trailers	38	38	30
Equipment Reduction (Number of vehicles)	--	15	23
Annual Depravation Reduction	--	\$38,450	\$58,850
Annual Maintenance Reduction	--	\$22,590	\$34,536
Annual Labor Reduction	--	\$ --	\$180,000
Annual Fuel Savings (based on 10 gal/vehicle week)	--	\$ 7,500	\$ 7,500
Area Preparation & Temporary Office	--	<u>(\$ 3,500)</u>	<u>\$ --</u>
		\$65,040	\$280,882

TOTAL ANNUAL SAVINGS GOING INTO 1986 = \$345,926

*excludes Maintenance Department vehicles